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THESIS

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OPTIMIZING THE POST-START U.S. STRATEGIC NUCLEAR FORCE MIX

by

David Allan Leary

June 1989

Thesis Advisor: Jan S. Breemer

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This thesis examines the impact a START agreement might have on the United States and Soviet strategic nuclear forces. It then proposes an "optimum" post-START force mix for the United States and the Soviet Union.

The current, as well as projected, post-START targeting policies are discussed. It is concluded that the impact of a START agreement on the current U.S. strategic targeting policy will be minimal. Although the target data base will not shrink as much as the forces tasked to cover it, a prioritization of targets is all that should be necessary with a post-START force.

A START agreement will mean major reductions in U.S. and Soviet strategic nuclear forces. As proposed in this thesis, only the ICBM leg of the Triad will require any major re-structuring. This would include the addition of mobile ICBM systems. The SLBM and bomber legs will feel minimal changes (i.e., retiring POSEIDON SSBNs and retiring or

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18. Continued: converting some older B-52s).

It is recommended that the B-2 program be cancelled, and funding be re-directed into mobile ICBM systems. By doing so the United States could utilize technology available today to strengthen its forces and not gamble on the low-observable technology which a "stealth" bomber might have.

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Optimizing the Post-START U.S. Force Mix

by

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Lieutenant Commander, United States Navy
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Submitted in partial fulfillment
of the requirements for the degree of

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It is recommended that the B-2 program be cancelled, and funding be redirected into the mobile ICBM systems. By doing so the United States could utilize technology available today to strengthen its forces and not gamble on the low observable technology which a "stealth" bomber might have.

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I. INTRODUCTION AND BACKGROUND

A. INTRODUCTION

Negotiations have been ongoing since 1981 towards achieving a Strategic Arms Reduction Treaty (START). During this period the Soviet Union and the United States have come closer to reaching an agreement, overcoming several obstacles. It is now the opinion of most "experts" that a START treaty will be signed by the super-powers at some time in the near future. Because of the likelihood of a START agreement becoming reality, it becomes necessary to evaluate current strategic force postures, capabilities, objectives and missions in order to postulate what type of force the United States must form in a post-START era.

This thesis attempts to develop, through logical reasoning, a post-START force mix that will meet most, if not all, of the objectives and missions necessary to ensure the national security interests of the United States.[1]

B. PURPOSE

Among those who follow the START negotiations and who have the "knowledge" and power to recommend future strategic force postures there exists a wide disparity of opinions on what type of post-START force is in the best interest of the United States. There are even those who feel that the consummation of START will not be in the best interest of the U.S. because it will create forces (both U.S. and Soviet) which will emphasize multiple warhead missiles and thus create a disparity between numbers of warheads and launchers which could "tempt" each side to attempt to destroy the other's arsenal before it can be launched.[2]

---

[1] "Force mix" is used here to mean the number and types of weapons systems which comprise the three legs of the Triad. The Triad is made up of a mix of intercontinental ballistic missiles (ICBMs), submarine launched ballistic missiles (SLBMs), and bombers equipped with nuclear gravity bombs and air launched cruise missiles (ALCMs). The term "deterrence," as used here, includes the concept of "extended deterrence" whereby the United States forces are positioned, planned, and structured in such a manner as to deter aggression against the U.S. and its allies.

Aside from the issue of force reductions associated with a START treaty, there has been much criticism of each "leg" of the U.S. Triad (usually by members of the services that "own" one of the other legs of the Triad). The criticism centers on the respective value of each leg with regard to its contribution to national security as well as its costs, vulnerabilities, and effectiveness. The following depicts the major criticisms regarding the value of each leg of the U.S. Triad:

1. ICBMs placed in silos are extremely vulnerable. They also have a large number of warheads mated to them which make them an attractive target for the Soviet Union's planners. The Soviets could conceivably eliminate the ten silo based warheads on a single PEACEKEEPER missile with only two reentry vehicles (RVs) of their own. This can create an attractive RV exchange ratio.

2. SLBMs may become vulnerable to Soviet anti-submarine warfare (ASW) forces. Since modern SSBNs carry a large number of warheads it is conceivable for the U.S. to lose a disproportionately large percentage of its strategic nuclear forces if only one SSBN is lost to Soviet ASW forces.[3]

3. Bombers are vulnerable to attack while on the ground as well as to surface-to-air missiles (SAMs) while in flight. They are "soft" targets and can be eliminated on the ground as well as knocked out of the sky while attempting to clear their homebase by the overpressure area created by the burst of a relatively inaccurate SLBM which has a short flight time, thereby allowing little alert and escape time.

---

[2] Henry A. Kissinger, "The Dangers Ahead," Newsweek, Vol. CX, No. 25, pp. 34-41, December 21, 1987.

[3] Up to 192 RVs for TRIDENT SSBNs loaded with 24 C4, TRIDENT I missiles (each carrying 8 warheads). It is presumed that the D5, TRIDENT II missile will also carry 8 warheads.

4. Multiple Independently Targetable Reentry vehicles (MIRVs) can be destabilizing by allowing more warheads to be placed on a smaller number of missiles thereby making it easier for the Soviets to successfully pre-empt the U.S. forces (ie. offering fewer targets). A single warhead ICBM would, by this same argument, be much more of a stabilizing asset because it would be harder to successfully pre-empt.[4]

With the strong arguments by each proponent of each area presented above, it becomes obvious that some balance of forces must be achieved in order to maximize the benefits of each type of weapon while at the same time reducing the potential drawbacks of each. It is the purpose of this thesis to postulate the plausible parameters, including numbers and types of weapons, of such a "balanced" post-START U.S. strategic force mix.

C. BACKGROUND

The formulation and justification of a balanced post-START force mix must begin with a review of U.S. strategic doctrine and objectives. Presented next must be a review of the current order of battle (OOB) of U.S. and Soviet strategic forces. Post-START force mix alternatives cannot be presented without first discussing the various U.S. and Soviet proposed START limitations; therefore, a brief review of the START limits, and debate, as reported in the public press, will be presented. With this concluded, it becomes possible to postulate a post-START force mix that can reasonably be expected to meet the objectives of U.S. national security.

1. Assumptions

The author's professional background has been in SSBN strategic weapons systems. Skeptics might accordingly question his "objectiveness," untainted by parochial loyalties. Every attempt is made to avoid argumentation unduly slanted towards SLBMs.

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[4] Tamar Jacoby and John Barry, "A Nuclear Balance?," Newsweek, Vol. CX, No. 25, p. 28, December 21, 1987.

Initially one of the objectives of this thesis was to conduct a cost-benefit analysis of the three legs of the Triad and thus hopefully determine which "leg" provides the "most" for the "least". While conducting preliminary research it became obvious that it would too difficult to find reliable dollar figures that could ring true for each part of the Triad; there simply is no standard method for recording spending, especially when it involves such complex systems as strategic nuclear weapons.

Finally, although it has become painfully clear recently that the money managers will have a big say in what shape the military will take and what roles and missions it will perform (and not perform) this paper examines the issues and makes recommendations based on military value, unconstrained by budgetary considerations. The latter, like the different arguments presented above, is another item that must be balanced with the military importance of any projected system. This thesis is concerned with U.S. strategic force requirements and goals that maximize military potential. In doing so it may not maximize financial efficiency. But then, what price can be placed on maintaining the national security?

2. U.S. Strategic Doctrine and Objectives

American doctrine regarding the use of nuclear weapons has evolved now for about four decades. Technological changes in weapons and delivery systems have resulted in changes in the employment policies. To get to the source of the requirement for U.S. strategic weapons doctrine one must review the statements of the national interest and objectives. The latter is found in the FY 1989 Annual Report to Congress made by U.S. Secretary of Defense, Frank C. Carlucci:

> "America's preeminent national security interest is the survival of the United States as a free and independent nation, with its fundamental values and institutions intact, and its people secure. We also seek to promote the growth of freedom, democratic institutions, and free market economies throughout the world, linked by fair and open international trade. More specifically, we support the security, stability and well-being of our allies and other nations friendly to our interests. We oppose the expansion of influence, control, or territory by

nations hostile to freedom and to other fundamental values shared by America and its allies."[5]

The national interests are intended to be supported by a series of national security objectives. Objectives that are germane to the national interests presented above include:

a. To deter hostile attack of the United States, its citizens, military forces, or allies and to defeat attack if deterrence fails.
b. To prevent the domination of the Eurasian landmass by the Soviet Union, or any other hostile power or coalition of powers.
c. To maintain stable regional military balance vis-a-vis the Soviet Union and states aligned with it.[6]

The essential means for securing U.S. interests and objectives is "deterrence." The President's Commission on Strategic Forces accordingly reported that, "American strategic forces exist to deter attack on the United States or its allies--and the coercion that would be possible if the public or decision makers believed that the Soviets might be able to launch a successful attack."[7] The report goes on to state that, "...if they should ever choose to attack, they should have no doubt that we can and would respond until we have so damaged the power of the Soviet state that they will be unmistakably worse off...."[8]

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[5] Frank C. Carlucci, Secretary of Defense, Fiscal Year 1989 Annual Report to Congress, p. 18, U.S. Government Printing Office, Washington, D.C., 1988.

[6] Ronald Reagan, U.S. President, National Security Strategy of the United States, p. 4, The White House, U.S. Government Printing Office, Washington, D.C., January 1988.

[7] Report of the President's Commission on Strategic Forces, Brent Scowcroft, Chairman, p. 2, U.S. Government Printing Office, Washington, D.C., 1983.

[8] Report of the President's Commission on Strategic Forces, p. 2.

Deterrence is achieved by maintaining a credible strategic force structure with the ability to inflict unacceptable damage, and by demonstrating unquestionable resolve to utilize the strategic forces against the very heart of the Soviet Union (or other aggressor) when deemed necessary by the National Command Authority (NCA). The question of what constitutes a "credible force structure" is at the heart of this thesis.

Since there has been no exchange of nuclear weapons with the Soviet Union (or any other country), and there has been no direct military conflict with the Soviet Union, it can arguably be claimed that U.S. strategic nuclear forces have performed their deterrent function admirably. In a post-START environment the U.S. will have to maintain this "credibility" by selectively choosing which forces to eliminate and which to retain and modernize or develop. In defining its post-START force structure, the U.S. must always keep in mind the elements of the national interest and the national security objectives mentioned earlier, for it is the deterrence which results from these forces which allow this country to achieve these objectives and safeguard its vital interests.

3. Current U.S. and Soviet Forces

The U.S. and Soviet Union maintain strong nuclear forces in order to protect their interests and the interests of their allies. These strategic nuclear forces are made up of ICBMs, SLBMs, and bombers (i.e., the three legs of their respective Triads). The current order of battle for U.S. and Soviet strategic nuclear forces are presented in Tables 1 and 2.[9] Only bombers dedicated to strategic nuclear roles are included in

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[9] In order to standardize the data presented in Tables 1 and 2, the Single Shot Kill Probabilities (SSKPs) have been calculated against a 5,000 psi target. The method for calculating the SSKPs is as follows:

$SSKP = [1-(0.5^{A}]$, where $A = [6(Y^{.667})]/[H^{.667}(CEP)^{2}]$ "Y" is the yield in megatons, "H" is the hardness of the target in pounds per square inch (psi), and CEP is expressed in nautical miles (nm). Source of the formula is Congressional Budget Office, TRIDENT II: Capabilities, Costs, and Alternatives, Appendix A, Government Printing Office, Washington, D.C., July 1986, originally cited in Lynn Davis and Warner Schilling, "All You Ever Wanted To Know About MIRV and ICBM the numbers. The 69 B-52s which have been "converted" and assigned to conventional roles only have been omitted. Bomber forces are given their maximum nuclear payload and START counting rules are assumed as follows:

a. Penetrating bombers (i.e., those that do not use long range standoff weapons) are counted as one nuclear weapon regardless of actual payload.

b. Standoff bombers (i.e., cruise missile carriers) are credited (under Soviet counting rules) with whatever the maximum payload each aircraft can carry. U.S. proposals are to count each cruise missile carrying aircraft as 10 weapons regardless of actual payload.

The circular error probable (CEP) listed in Tables 1 and 2 is a measure of missile accuracy. It is the radius of a circle drawn around a target such that a warhead aimed at that target has a 50 percent probability of detonating within or above that circle. To reflect uncertainty regarding the precise CEP of each system, CEP estimates have been rounded to the nearest 100 feet.[10]

Calculations But Were Not Cleared To Ask," Journal of Conflict Resolution, Vol. XVII, No. 2, June 1973. The overall system reliabilities have not been included because of a lack of accurate figures in open literature.

[10] Congressional Budget Office, TRIDENT II: Capabilities, Costs, and Alternatives, Chapter I, Table 2, note (a), Washington, D.C., July 1986.

TABLE 1: CURRENT SOVIET STRATEGIC NUCLEAR FORCES

Missile	Range (nm)	CEP (ft)	Yield (kt)	#RVs/ WPN	SSKP (%)	Platform/ Basing	# of Platforms	Total # of Missiles	Total # of RVs
SS-N-6	1800	4900	1000	1	2.1	YANKEE I	16	256	256
SS-N-8	5500	5000	800	1	1.7	DELTA I/II	22	280	280
SS-N-17	2500	4000	500	1	2.0	YANKEE II	1	12	12
SS-N-18(3)	4000	3000	100	7	1.0	DELTA III	14	224	1568
SS-N-20	5100	1640	100	8	4.1	TYPHOON	6 ~~5~~	~~100~~ 120	~~800~~ 960
SS-N-23	5100	1640	100	10	4.1	DELTA IV	7 ~~4~~	~~64~~ 2	~~640~~ 1,120

Total # SSBN RVs ~~3556~~ 4196

Missile	Range (nm)	CEP (ft)	Yield (kt)	#RVs/ WPN	SSKP (%)	Platform/ Basing	# of Platforms	Total # of Missiles	Total # of RVs
SS-25	6500	600	550	1	61.5	ROAD MOBILE	~~100~~ 270	~~100~~ 270	~~100~~ 270
SS-24	6500	600	100	10	26.4	RAIL MOBILE	~~50~~ 80	~~50~~ 80	~~500~~ 800
SS-18(4)	6800	700	500	10	48.2	SILO	308	308	3080
SS-19(3)	6000	900	550	6	34.7	SILO	~~350~~ [illegible]	~~350~~ [illegible]	~~2100~~ [illegible]
SS-17(3)	6200	1200	500	4	20.1	SILO	~~138~~ 70	~~138~~ 70	~~552~~ 280
SS-13	5800	6000	600	1	1.0	SILO	~~60~~ 40	60 10	~~60~~ 40
SS-11	8000	3600	1000	1	3.9	SILO	~~420~~ 335	~~420~~ 335	~~420~~ 335

Total # ICBM RVs ~~6812~~ 6605

Total Soviet Ballistic Missile RVs 10368 [illegible]

Bomber	Range (nm)	Weapon	Yield (kt)	Weapon Range (nm)	Payload	# of Bombers	Total # of Weapons	START # of weapons
BLACKJACK	8000	AS-15	200	1860				
BEAR H	9000	AS-15	200	1860	8	70+	560+	560+
BEAR G	9000	AS-4	350	250	2	45+	90+	45+

Total Bomber Delivered Weapons 650+

Total START Count Bomber Delivered Weapons 605+

Total Soviet Strategic Nuclear Weapons 11018+

Total Soviet Strategic Nuclear Weapons (START count 10973+

Sources: Same as [illegible] [illegible] Sov Mil Power [illegible] [illegible] this

Sources: Listed in Table 2.

TABLE 2: CURRENT U.S. STRATEGIC NUCLEAR FORCES

Missile	Range (nm)	CEP (ft)	Yield (kt)	#RVs/ WPN	SSKP (%)	Platform	# of Platforms	Total # of Missiles	Total # of RVs
TRIDENT II	6000	500	475	8	78.9	TRIDENT			
TRIDENT I	4500	900	100	8	15.9	TRIDENT/POS	8/12	384	3072
POSEIDON	2750	1500	40	10	3.1	POSEIDON	15	240	2400
								Total # SSBN RVs	5472
MX	6000	300	300	10	92.3	SILO	50	50	500
MMIII	6000	600	335	3	56.8	SILO	510	510	1530
MMII	6000	2100	1200	1	16.9	SILO	450	450	450
								Total # ICBM RVs	2480
								Total U.S. Ballistic Missile RVs	7952

Bomber	Range (nm)	Weapon	Yield (kt)	Weapon Range(nm)	Payload	# of Bombers	Total # of Weapons	START # of weapons
B-52G	6500	ALCM	200	1550	12	98	1176	1176
		SRAM	170	125	20		1960	98
B-52H	8700	ALCM	200	1550	12	96	1152	1152
		SRAM	170	125	20		1920	96
B1-B	6500	ALCM	200	1550	22	97	2134	2134
		SRAM	170	125	24		2328	97
							Total Bomber Delivered Weapons	10670
							Total START Count Bomber Delivered Weapons	4753
							Total U.S. Strategic Nuclear Weapons	18622
							Total U.S. Strategic Nuclear Weapons (START count)	12705

SOURCES: TRIDENT II: Capabilities, Costs, and Alternatives, pp. 10-11 and Appendix A, Congressional Budget Office, Washington, D.C., July 1986 (Originally cited in numerous sources); "The Yields of Soviet Strategic Weapons," Lynn R Sykes and Dan M. Davis, Scientific American, pp. 29-37, Vol. 256, No. 1, January 1987; Strategic Arms Reduction Talks After the Moscow Summit, p. 13, U.S. Senate Republican Policy Committee, William L. Armstrong, Chairman, June 29,1988; Soviet Military Power: An Assessment of the Threat, 1988, p. 48, U.S. Government Printing Office, Washington, D.C., 1988; United States Military Posture FY 1989, p. 39, The Joint Staff, U.S. Government Printing Office, Washington, D.C., undated; The Military Balance 1987-88, pp. 203 and 207, International Institute for Strategic Studies, London, England, 1988; Jane's Fighting Ships 1988-89, pp. 545-548, Jane's Publishing Co., London, England, 1988; Jane's Weapons Systems 1988-89, pp.7-11, 14-18, 265, 268-269, 368-369, 448, and 463-465, 717-718, and 721, Jane's Publishing Co., London, England, 1988.

There are advantages and disadvantages to each leg of the Triad. Some are major areas for concern, while others are very minor. The advantages and disadvantages of each leg should be considered when assembling a force structure, thus creating a "balanced force." The major advantages and disadvantages of each leg of the Triad have been summed up by Secretary of Defense Carlucci as follows:

> "Our deployed submarines are practically invulnerable, but SLBMs currently are less accurate than our ICBMs. Our ICBMs have higher alert rates and provide a more prompt response, but their fixed basing increases their vulnerability. Our bombers are accurate and recallable, but their response is slower than that of ballistic missiles. In their entirety, the synergistic capabilities provided by the three types of weapons systems incorporate all of the elements necessary to deter any type of nuclear attack."[11]

The major advantages that have historically been ascribed to possession of a mix of strategic forces are that (1) the Soviets are precluded from being able to eliminate U.S. nuclear forces by concentrating their efforts on a "single strategic solution," and that (2) by distributing forces on land, sea, and in the air, the Soviet targeting problem is complicated. With the historical success of U.S. strategic force mixes being able to deter aggression, it is likely that all three legs of the Triad may continue to play important roles in a post-START force mix, eventhough all three legs are likely to be reduced. The importance of each leg, as well as the need for maintaining a Triad, as opposed to a "Diad" or some other force, are investigated in depth in this thesis, and conclusions are drawn regarding which type of force will best suit the needs of the nation.

4. START Limitations and Obstacles

Over the past eight years of START negotiations the goals of reducing the strategic nuclear arsenals of the United States and the Soviet Union have come closer to realization. There are, however, several issues yet to be resolved. These issues involve the U.S. Strategic Defense Initiative (SDI), mobile land-based missiles, air-launched cruise missiles (ALCMs), limitations on sea-launched cruise missiles

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[11] FY 1989 Annual Report to Congress, p. 54.

(SLCMs), and the problems associated with verifying such a complex treaty. U.S. and Soviet differences as of June 1988, are presented in Table 3.

TABLE 3: U.S. AND SOVIET START POSITIONS

	U.S. Position	Soviet Position
SNDVs	1,600	1,600
--mobile ICBMs	banned	permitted
--(SLCMs)	not limited by START no explicit limit	part of START (400 nuclear SLCMs, [illegible]00 conventional)
WARHEADS	6,000	6,000
--ballistic missile warheads	4,900	4,900
--sub-ceiling	3,300 on ICBMs (prefers 3,000)	3,300 on SLBMs
--ALCMs	no explicit limit	1,100
--heavy ICBM warheads	50% cut (to 1,540)	50% cut (to 1,540)

NOTE:[12] SNDVs have traditionally referred to launchers of ICBMs (intercontinental ballistic missiles), launchers of SLBMs, and heavy bombers capable of delivering their warheads at intercontinental range. The United States would like the START Treaty to limit deployed missiles, rather than the launchers for those missiles.

The U.S. and Soviet rationales for these different limits are not discussed. Discussed instead are their possible implications, since they are the best indicator for the final force posture.

Among the outstanding issues needing resolution prior to signing any kind of a START agreement, SDI is perhaps the most volatile. The Soviets continue to state that there will be no agreement without banning SDI. The U.S. position is "...to allow both sides to continue research, development and testing as required, which is permitted by the ABM Treaty, and not to withdraw from the ABM Treaty, for a specified period."[13] The United States feels that after the agreed period, each side will be free to choose whether or not to maintain the ABM Treaty. The Soviet stance is that both sides should continue to comply unless both come to some other agreed upon outcome. Neither side has yet to agree upon what type of testing would be permitted by the ABM Treaty.

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[12] Congressional Research Service, START: A Current Assessment of the U.S. and Soviet Positions, p. CRS-2, Washington, D.C., June 3, 1988,. This document will henceforth be referred to as the CRS Study.

Indications are that the issue of mobile missiles may be resolved. The "formal" U.S position is to ban all mobile missiles unless verification problems can be resolved. The Soviets favor the mobiles with limits on launchers and warheads. Apparently, the feeling after the Moscow Summit is that the "U.S. appears to be moving off its proposal to ban mobile missiles."[14] Actual issues associated with mobiles (ie. deployment areas, verification, monitoring production facilities, etc..) are complex and not the subject of this thesis.[15]

The ALCM issue centers on range and bomber payload. The SLCM debate is stuck in the area of verification and the difficulty of telling conventional from nuclear weapons. The overall area of verification poses a very tough obstacle. Both sides seem to want to come to some type of START agreement so that, in time, all verification issues, and others mentioned, should be resolved.

5. General Issues Associated with START

Starting in 1950s and early 1960s the United States and the Soviet Union began to build their massive nuclear arsenals. As seen in Tables 1 and 2 both countries now have in excess of 10,000 strategic nuclear weapons in their respective inventories. The fact that both superpowers have agreed to embark on the START process is evidence that neither side believes that further expansion will add to its security, that indeed, smaller arsenals can enhance the security of each. START presents a vehicle for both countries to maintain credible, modern, and effective nuclear forces at substantially reduced levels. This reduction of strategic nuclear forces should contribute to a more stable international environment, thereby, hopefully, making the world a safer and better place to live.

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[13] U.S. Senate Republican Policy Committee, William L. Armstrong, Chairman, Strategic Arms Reduction Talks; After the Moscow Summit, pp. 5-6, Washington, D.C., June 29, 1988.

[14] Strategic Arms Reduction Talks; After the Moscow Summit, p. 6.

[15] If the United States is willing to withdraw its proposal to ban mobile missiles, it will be interesting to see if the Soviets are willing withdraw their proposal to limit SLCMs and tie them to a START deal.

The Strategic Arms Limitation Talks (SALT) treaty limited delivery vehicles and launchers. This encouraged both sides to exploit the relatively novel technology of MIRVs, and maximize the number of warheads per delivery vehicle. With START, this rationale will change. By limiting actual warhead numbers, in most systems, there should be a tendency to move away from MIRV systems and to systems that have fewer, if not single, warheads. By placing reduced numbers of warheads on the missiles each side can maximize delivery vehicles, thereby maximizing the number of targets the opposition must cover. This should result in strengthening deterrence by making it much harder, if not impossible, for either side to successfully conduct a pre-emptive strike.

Historically the Soviets have been very evasive and difficult to deal with in arms control talks. A recent article by Ken Adelman, ex-director of the U.S. Arms Control and Disarmament Agency, exemplifies the determination and patience needed by U.S. negotiators to have any chance for a successful agreement.[16] Since the outcome of a START agreement appears to be in the best interest of both countries it is likely that both sides will continue to return to the bargaining table, no matter how nerve-wracking the negotiations become.

In later chapters this thesis examines the targeting policy currently used by the United States and will project possible implications a START deal might have on this targeting policy. A review of how START might impact the Soviet Union is also presented, as are effects on U.S. forces. Finally, a "candidate" post-START U.S. strategic force mix is presented and discussed.

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[16] Ken Adelman, "Arms Control: Games Soviets Play," Readers Digest, Vol. 134, No. 803, pp. 65-69, March 1989.

II. START AND TARGETING

Current U.S. and Soviet targeting policies for strategic nuclear weapons have evolved along with weapons systems technology. With the signing of a START agreement it is likely that both U.S. and Soviet targeting policies will require extensive revision. This chapter reviews current U.S. targeting doctrine and investigates possible future targeting options which may be effective in a post-START era.

A. CURRENT U.S. TARGETING POLICY

> "Current U.S. targeting policy has a direct historical lineage to the beginning of the Nixon Administration, when the first substantive moves were made to review the 1962 SIOP. The past decade has been one of continuous official effort to increase the range of strategic nuclear targeting options available to the President, including an extensive array of counterforce options, and to enhance the possibility that these options could be exercised in such a way that escalation could be controlled."[1]

As stated above, current U.S. targeting policy is mainly one of counterforce. This counterforce emphasis has evolved from the countervalue-centered "assured destruction" doctrine of the 1960's.[2] As this shift took place the targeting data base began to grow immensely. Between 1974 and 1980 the number of targets grew from about 25,000 to more than 40,000.[3] This large group of targets has been divided into four distinct groups with sub-groups within each. The four targeting groups are as follows:[4]

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[1] Desmond Ball, Targeting for Strategic Deterrence, Adelphi Paper No. 185, p. 17, International Institute for Strategic Studies, London, England, 1983.

[2] Countervalue targeting is assumed to be population targeting, while counterforce targeting is designed to hold military forces (nuclear and conventional) as well as military industry and command and control centers at risk.

[3] Ball, p. 23.

1. Strategic Nuclear Forces - Examples include ICBMs and IRBMs, together with their launch facilities and launch command centers; nuclear weapons storage sites; airfields supporting nuclear-capable aircraft; nuclear ballistic submarine (SSBN) bases.

2. Other Military Targets (OMT) - OMTs include primarily conventional military forces such as barracks, supply depots, marshalling points, conventional airfields, ammunition storage facilities, and tank and vehicle storage yards.

3. Leadership and Control - This target set includes national command and control and leadership centers.

4. Economic and Industrial - This set of targets is divided into two groups: those dealing with war-supporting industry, and those which deal with industry that would contribute to economic recovery.

Examples include:

a. War Supporting -
 -ammunition factories
 -tank and armoured personnel carrier factories
 -petroleum refineries
 -railway yards and repair facilities

b. Economic recovery-
 -coal
 -basic steel
 -basic aluminum
 -cement
 -electric power

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[4] Robert A. Blaise, "Historical Compendium of U.S. Nuclear Strategic Forces Policy and Doctrine," AIM 81-T-6, pp. 42-43, prepared for Department of the Navy, Office of Naval Research, Arlington, VA, September 1981, and Ball, pp. 23-24.

The targeting scheme for employment of nuclear weapons is divided among several options, each designed for a specific purpose. These options include Major Attack Options (MAOs), Selective Attack Options (SAOs), Limited Nuclear Options (LNOs), and Regional Attack Options (RAOs). Options can be utilized independently or in combination, depending on the situation. Each option also allows for "withholds" for the purpose of sparing specific target categories. It is clear that targeting is a complex task with numerous options intended to maximize flexibility.[5]

B. FLEXIBLE RESPONSE

Rather than simply choosing either a pure counterforce or pure countervalue targeting policy, a mix of both policies may provide the flexibility desired by the NCA. A "flexible response" policy is such a mix. Such a policy would provide for targeting all types of targets, military and civilian, and allow for the prosecution of assured destruction as well as damage limitation strategies. Such a policy would continue to emphasize "all-out" deterrence while also offering a maximum amount of targeting flexibility should deterrence fail.

This type of flexible response posture has its roots in Robert S. McNamara's tenure as Secretary of Defense. In a statement he delivered in 1965 before the House Armed Services Committee, McNamara explained that the objective of U.S. strategic nuclear forces is to deter aggression.[6] In order to deter aggression these forces must be able to inflict unacceptable damage on an attacker should deterrence fail. To create a force which could deter aggression on one hand, and be capable of inflicting unacceptable damage on the other hand, he proposed that U.S. nuclear forces maintain two capabilities. The first of these capabilities, he explained, "...we call Assured

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[5] Ball, p. 24.

[6] Statement of Secretary of Defense Robert S. McNamara before the House Armed Services Committee on the Fiscal Year 1966-70 Defense Program and 1966 Defense Budget, p. 37, Washington, D.C., February 18, 1965.

Destruction, i.e., the capability to destroy the aggressor as a viable society, even after a well planned and executed surprise attack on our force. The second capability we call Damage Limitation, i.e., the capability to reduce the weight of an enemy attack by both offensive and defensive measures and to provide a degree of protection for the population against the effects of nuclear detonations."[7]

Though almost 25 years old, this type of targeting policy may still be the most appropriate for today's forces and the forces that will remain upon the conclusion of a START pact. The Assured Destruction forces would include some of the ICBMs and SLBMs as well as the manned bombers. The offensive aspect of the Damage Limitation forces would include the remainder of the ICBMs, SLBMs and the manned bombers. The defensive aspect of the Damage Limitation forces would include anti-bomber forces, anti-SSBN forces (i.e., SSNs), and any type of anti-ballistic missile systems (including SDI systems). These forces would target a mixture of counterforce and countervalue targets according to whatever role each would play in the flexible response strategy.

C. FORCE REDUCTIONS AND TARGET REDUCTIONS

Ideally each side would have a number of targets equal to the number of weapons the other side has. This would allow for complete coverage of all targets and would, in the opinion of many students of deterrence, maximize deterrence by eliminating the advantages of launching first in an attempt to disarm the other side. The reality is that the actual targeting data base will be much larger than the arsenals of either side. With the proposed force reductions of START, both sides would be limited to 6,000 strategic nuclear weapons. This amounts to approximately a 50 percent reduction in strategic forces for both sides (see Tables 1 and 2). Although the forces would be cut by about 50 percent the target base would not shrink proportionally. This is where the post-START targeting problem can occur: how can the United States strategic nuclear forces maintain the flexibility to cover all necessary targets while being cut by 50 percent? The Soviet Union will face the same dilemma, of course.

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[7] McNamara's statement to the House Armed Services Committee, p. 38.

Despite the force reductions and the obvious elimination of SNF targets,[8] the remainder of the targeting data base remains essentially unchanged. Thanks to MIRV technology the elimination of one RV does not necessarily mean the elimination of one target. This means that although the strategic forces may be cut by up to 50 percent, the number of delivery vehicles (i.e., targets) will most likely not be proportionally reduced.

A recent study conducted by Martin Marietta for the Department of Defense, analyzed the post-START target numbers.[9] The actual report has not been released to the public but certain aspects have been released and were cited in the 22 April 1989 issue of Jane's Defence Weekly:

> "The report details more than 10,300 strategic Soviet targets including: Priority 1 targets (military assets): 1,500 ICBM silos and launch control centers, 130 strategic submarine bases and support facilities, 80 operating and staging bomber airfields, 140 medium-range missile bases, 94 nuclear weapons storage sites, 50 command posts, 2,240 key communications facilities, 20 ballistic missile defense sites, 67 interceptor aircraft bases, 900 fixed strategic surface-to-air missile sites, 1,200 early warning radars, and 670 additional major complexes and airfields.
> Priority 2 targets (Soviet leadership network): 1,500 to 1,600 targets consisting of: leadership bunkers, command and control centers, national and regional command posts.
> Priority 3 targets (Soviet war supporting industry): 1,500 to 1,600 targets consisting of: nuclear weapons production facilities, power plants, hydro-electric

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[8] From Table 1 and analysis to be presented in Chapter IV, Soviet Strategic Nuclear Delivery Vehicles (SNDVs), which can be seen as Strategic Nuclear Forces (SNF), are as follows: present forces - 1,603 (not including any BLACKJACK bombers and counting each SSBN as 1 SNF); post-START forces - 1,278 (including a projection of the number of BLACKJACK bombers). This is a reduction in the number of SNFs of only 325 while at the same time there is almost a 50 percent reduction in the Soviet nuclear arsenal.

[9] Barbara Starr, "Pentagon studies 'most survivable' US ICBM force mix", Jane's Defence Weekly, Vol. 1, No. 16, pp. 678-679, April 22, 1989.

> facilities, manufacturing facilities for critical components and military hardware production facilities."[10]

The report also detailed the numbers of targets that the United States must be able to "hold at risk" and destroy within one hour of a surprise attack. These include:

> "...eight deeply buried national leadership command centers; 25 super-hardened ICBM strategic reserve sites; four ABM launch facilities; 37 regional leadership bunkers; five submarine bases; 13 mobile ICBM sites; 14 bomber sites; 24 air defense interceptor sites and 17 strategic seaports."[11]

Thus it becomes clear that the target base will remain large and diverse, and will require some sort of prioritization by U.S. target planners in assigning targets to the reduced number of assets in a post-START force.

Another aspect of reducing strategic nuclear forces is that, by cutting forces by as much as 50 percent, the relative value, or importance, of each weapon will increase. This could mean that with a reduced force, each side may be less willing to plan on riding out a first-strike by the other side because of the potential damage which their more vulnerable assets of a reduced force may incur. The reduced forces could make options such as Launch on Warning (LOW) and Launch Under Attack (LUA) look attractive.[12] One way to avoid having to resort to LOW/LUA type strategies would be to minimize the vulnerability of the forces, thereby making it as difficult as possible for the other side to eliminate them.

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[10] Starr, pp. 678-679. Information similar to this can also be found in Michael M. May, George F. Bing, and John D. Steinbruner, Strategic Arms Reductions, p. 32, Brookings Institution, Washington, D.C., 1988.

[11] Starr, p. 679.

[12] Launch on Warning is a strategy whereby weapons of one side would be launched at another side if it is felt that the other side has either launched or is about to launch an attack against you (tactical warning) or seems to be in the process of preparing to launch an attack (strategic warning). Launch Under Attack is a strategy whereby weapons of one side are launched against another side when it is felt that they are under attack from the other side either by actual nuclear detonations on their homeland or by technical indications of impending detonations.

In a force reduced by approximately 50 percent the concept of "extended deterrence" may become more difficult. Although current strategic forces seem to be able to accommodate this, once forces are reduced (and target bases remain almost the same as before) the "extended deterrence" policy will have to be re-evaluated and targets prioritized along with others.

D. POST-START TARGETING OPTIONS

As discussed above, current U.S. targeting policy includes a great amount of flexibility. With a Post-START force, reduced by about 50 percent, it is likely that although the basic objectives of a flexible targeting strategy can be retained, existing targeting priorities will probably need to be re-evaluated. A target data base of over 40,000 being covered by only about 6,000 weapons (as opposed to 12,000) may cause the targeting strategy to lose some of its flexibility unless careful planning and prioritization takes place. In a damage limiting role, SNF targets would still be high on the priority list because eliminating them would greatly reduce the potential damage they could do to the United States. OMTs would require careful prioritization since there are many more OMTs than weapons available. Overall objectives of the nuclear forces and the nation's intentions will play important parts in setting the priorities of this category of targets. The remaining target sets (i.e., leadership and control, and economic and industrial) will require the same scrutiny as the OMTs.

As mentioned above, one possible post-START strategy could be to adopt a LOW/LUA policy. These policies can be seen as contributing to deterrence through a stated threat to any potential aggressor that first indication of an attack on the United States will automatically trigger retaliation. The major drawback of a LOW/LUA posture is that is reduces the flexibility of the NCA and lowers crisis stability. Because of these reasons LOW/LUA policies should not be the sole strategy of the post-START forces but could play a part in the overall scheme.

What type of post-START force structure the United States decides to retain can dictate targeting policy. If the United States opts to build up a force comprised totally of ICBMs, a counterforce policy may seem most logical based on the accuracy of the ICBMs.[13] Unless the silos were super-hardened and made essentially invulnerable to direct hits from nuclear weapons this type of force would be compatible with a LOW/LUA strategy. On the other hand, a force made up of only SLBMs and mobile ICBMs could be used in a counterforce or countervalue role, while LOW/LUA would not seem necessary as both types of systems would have relatively good survivability. Thus, the capabilities of each part of the Triad must be considered prior to cutting forces as each has its own contributions to the Triad as well as its limitations, and the resultant force will have an effect on what type of targeting policy the nation adopts.

E. CONCLUSIONS

The post-START targeting problems will be difficult to solve. U.S. planners will be trying to maintain the flexibility required by the NCA while at the same time they will be targeting a slightly reduced target base with a drastically reduced nuclear force. Target priorities and mission objectives will have to be clear to the planners in order to achieve national objectives in the event deterrence fails. The structure of the post-START force must provide a clear message to any potential aggressors that this force provides the flexibility and capabilities to strike anywhere under the worst possible circumstances. It is the planner's job to take the capabilities of the post-START force and employ them in such a manner as to maximize the effectiveness of the force in obtaining the objectives of the nation.

Based on the discussion above, the post-START force targeting strategy should be similar to that which is in place today. The targeting policy will be dependent on what type of post-START force mix is achieved. It should be capable of providing the NCA with flexibility in its options and should not be limited to only one type of strategy (i.e., counterforce or countervalue). The post-START targeting strategy may have a portion of the forces which could not survive a direct nuclear attack (such as the silo based ICBMs) dedicated to a LOW/LUA policy. However, in order to maintain crisis stability and to preclude an accidental nuclear war this portion of the force should be kept to a minimum and the LOW/LUA policy invoked only during periods of increased tensions. The remainder of the force should be capable of targeting any type of target set. The priorities of targets should be re-evaluated since the number of available weapons will be greatly reduced. In summary, the targeting doctrine of the post-START era will be essentially the same as it is now with some possible shifting of target priorities and potentially increasing the importance of defensive measures (i.e., SDI, anti-SSBN operations and air-defense).

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[13] This would not, however, rule out the obvious countervalue capability which does not require great accuracy.

III. START AND U.S. FORCES

The basic mission of the U.S. strategic nuclear forces is best summed up by the following statement, presented by the Joint Chiefs of Staff in United States Military Posture FY 1989:

> "The fundamental objective of U.S. nuclear forces is to remove all incentives for direct attack against the United States and its allies by maintaining the capability to deny the Soviets their objectives under all circumstances and unacceptably damage the most valuable Soviet assets.... Equitable and verifiable arms reduction agreements are being pursued in parallel with modernization programs. The goal of the United States is a more stable nuclear balance at lower levels of armament."[1]

Although not usually thought to be one of the elements of the mission of the U.S. nuclear forces, it is clear from the quote above that arms reductions are part of the mission.

A START deal will effect the overall numbers of both the Soviet and U.S. strategic forces. The post-START forces of the United States must still be able to meet the objectives quoted above. This chapter considers the implications of a START treaty on the strategic nuclear forces of the United States, and lays the groundwork for later examination on how the nation will be able to meet declared force objectives and intentions with forces reduced by about 50 percent.

A. OBJECTIVES AND CAPABILITIES OF U.S. STRATEGIC FORCES

The basic objective of the strategic forces of the United States is deterrence. As mentioned previously, the method of deterrence for the U.S. is a combination of a force which can ride out a nuclear strike and still inflict "unacceptable" damage on the Soviet Union (assured destruction), and one which can limit damage to the United States by destroying Soviet SNFs (damage limitation). The Soviet Union realizes, or must be made to realize, that should it launch a nuclear attack on the United States, the United States nuclear forces will retain the capability to unleash mass destruction on the Soviet homeland. The Soviets must also believe that the United States is willing to use its nuclear forces if necessary. Thus, the United States maintains a strong, credible, survivable strategic nuclear force, which has the mechanisms built into the release systems to allow the NCA to retaliate even under the worst possible conditions, i.e., even after the completion of a Soviet first strike. This force consists of land-based bombers, silo-based ICBMs, and SLBMs. This mix is designed to complicate the Soviet targeting problem, and acts as a hedge against the possibility of a Soviet "breakthrough" against one of the legs of the Triad.

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[1] Joint Chiefs of Staff, United States Military Posture FY 1989, p. 2, U.S. Government Printing Office, Washington, D.C., 1988.

A START agreement will cause the U.S. nuclear forces to be reduced by approximately 50 percent. Of course, it will also reduce Soviet nuclear forces by about the same amount. The remaining forces must meet the criteria mentioned above in order to present a force that can threaten and therefore deter Soviet aggression. A reduction in U.S. nuclear forces will have numerous implications for each leg of the Triad. A review of the roles and missions of each, as well as capabilities is presented below. Additionally, the impact of the START reductions on each component is discussed.

1. U.S. Strategic Bombers

Although the detailed mission descriptions for each leg of the Triad are found only in classified publications, the basic mission can nevertheless be determined with a reasonable degree of precision through analysis of the capabilities of each.

The Commander in Chief, Strategic Air Command, General John T. Chain, stated that "..the most versatile and flexible part of the Triad is the long-range, manned bombers, which can be recalled, redirected and reconstituted."[2] Chain also said:

> "The man on-board the bomber is crucial for detecting, identifying and attacking the growing number of Soviet relocatable targets -- those war-fighting assets that can be dispersed and relocated. The capability of the manned bomber to penetrate enemy airspace and seek and destroy these targets -- particularly the highly threatening mobile ICBMs -- is essential."[3]

The manned bomber offers many features which the other two legs of the Triad do not. The essential element is, of course, the flexibility that is intrinsic to the "tactical" use of a human being. Having a man in-the-loop creates several of the key aspects which cannot be found in either ICBMs or SLBMs. Specifically, the man can be used to locate targets (i.e., strategic relocatable targets [SRTs]), determine the condition of the target both prior to, and after an attack, evaluate strategic defenses, and conduct reconnaissance. The manned bomber also provides the only recallable strategic nuclear weapons system.[4]

The size of the United States strategic bomber force is listed in Table 2. The force is made up of aging B-52s and new, but far from trouble-free B-1Bs. B-52s are located on 11 main bases within the continental United States and one at Andersen Air Force Base in Guam.[5] The new B-1Bs are being placed at four bases which are located in the center of the United States.[6] The B-1B bases are located so as to reduce the depressed trajectory SLBM threat from Soviet SSBNs which could be located near the U.S. coast.[7]

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[2] General John T. Chain Jr., USAF, "Prepared for the Challenge, Anywhere, Anytime," Defense/87, p. 59, November-December 1987.

[3] Chain, p. 59.

[4] Recallable only when operating in a penetrating role and using short-range weapons and not the long-range, long time-of-flight ALCMs. Although bombers could still be recallable when performing in the standoff role and launching ALCMs, this should not be considered any different from withdrawing release authority from ICBMs and SLBMs prior to their launching.

[5] This number of bases includes those which have SIOP dedicated bombers as well as conventional B-52s assigned.

The drawbacks of the manned bombers have been briefly mentioned before. They are slow compared to a ballistic missile; they are extremely vulnerable while on the ground and to air defense systems and tactical fighter aircraft while in the air. They are also very expensive.

Vulnerability of bombers to nuclear attack has been the subject of many reports. In 1983 the Congressional Budget Office produced one such report which detailed the bomber survivability question.[8] According to this report only about 30 percent of the bomber force stands alert on a day-to-day basis. Day-to-day alert means that crews are ready for takeoff in a relatively short period of time.[9] Given strategic warning (i.e., enough time to generate to a crisis alert condition), it is anticipated that about 95 percent of the bomber force would be ready to launch. The study predicts that in a day-to-day posture only about 80 percent of the alert bombers would survive a nuclear attack.[10] The remaining bombers not on alert are assumed to be lost. This means that only about 25 percent of the bomber force will survive and 75 percent will be destroyed in an attack without strategic warning. The study also shows that, although the B-1B has the capability to "escape" its base faster than the B-52, and has its electronics hardened against the electromagnetic pulse of a nuclear blast (and is therefore somewhat less vulnerable than the slower, softer B-52), the differences in the survivability data between the two forces are less that 10 percent, in the most stressful scenarios, and in most others is less than 5 percent.[11] Thus, the B-1B will still have almost the same vulnerabilities to attack from nuclear ballistic missiles as the B-52.

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[6] Information on bomber base locations comes from the FY 1989 Annual Report to Congress, p. 237.

[7] No official sources were found which would elaborate on this point. However, basing the B-1Bs in Texas, Kansas, and North and South Dakota provides for a much longer flight for any missile system which might originate from along the coast of the United States (either west or east coast). It should also be noted that there is no evidence that Soviet SLBMs have a depressed trajectory capability.

[8] Congress of the United States, Congressional Budget Office, Modernizing U.S. Strategic Offensive Forces: The Administration's Program and Alternatives, Appendix E, Congressional Budget Office, Washington, D.C., May 1983.

[9] A "short period of time" has been defined as about six minutes and thirty seconds for day-to-day alert, and about two minutes and thirty seconds for bombers placed on "crisis alert." The source for these times is Alton H. Quanbeck and Archie L. Wood, Modernizing the Strategic Bomber Force; Why and How, p. 47, Brookings Institution, Washington, D.C., 1976.

A START agreement would greatly reduce the number of bombers from the present day numbers. As a result of this reduction several bases would likely be closed and hundreds, if not thousands, of Air Force personnel would no longer be needed to support and fly the eliminated bombers. The exact impact of the cuts is only speculative, but in most studies which attempt to project post-START force structures, it appears that the ICBMs and SLBMs get looked at very closely, while the bombers tend to be added as "alsos." This appears to be a reflection of the popular bomber vulnerability issue which was discussed above. It is the opinion of this author that most planners are reluctant to place a great deal of emphasis on the manned bombers and prefer to opt instead for the faster, less vulnerable ballistic missile systems.

The alternative to retiring a large number of strategic bombers would be to convert them to a conventional role. Although this can be done, and appears to be one of the logical choices, the problem of verification may make this a difficult task. How, after all, does one tell the difference between a nuclear capable B-52 and a non-nuclear capable B-52? The conventional weapons carried by a B-52 would use much of the same equipment and would appear very similar to that of the nuclear weapons. Projected over a long period of time, and weighing the advantages and disadvantages of simply converting some B-52s to a conventional role and developing methods enabling verification of the payload, the Air Force may come to the conclusion that it would be simpler and less costly to just dismantle the B-52s removed from nuclear duty.

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[10] Modernizing U.S. Strategic Offensive Forces: The Administration's Program and Alternatives, p. 105

[11] Modernizing the U.S. Strategic Offensive Forces: The Administration's Program and Alternatives, p. 107. Additionally, Quanbeck and Wood state that "..the B-1 reportedly has been designed specifically to increase its hardness." (p. 50) They credit the B-1 with a strength capable of withstanding a 3 psi overpressure, and the B-52 with only about a 1 psi "hardness." (p. 50)

2. ICBMs

The current United States ICBM force is listed in Table 2. The force numbers 1,010 missiles with 2,480 warheads. Many of the latter are potentially hard-target kill capable. The ICBM offers many advantages over the manned strategic bomber. Because it is a ballistic missile it can deliver a weapon to a target in a much shorter period of time than a bomber can. Because it is "fixed" in a precisely known location, "fire control solutions" can be very accurate. It is not considered vulnerable to conventional air defenses (i.e., SAMs, and tactical fighter aircraft). This fact, coupled with the weapon's stable silo environment and planned maintenance, means that the ICBM out-performs the bomber as a reliable means for getting a weapon to the target. Because it flies very fast it does not provide the enemy with a great deal of warning time prior to detonation. Finally, land-based ballistic missiles have the advantage of highly "positive" command and control, i.e. landlines of communication. This eliminates the problem of radio communications through the atmosphere which can become tenuous in a nuclear environment.

ICBMs do, however, have something in common with the manned bombers: they are vulnerable to attack prior to launching. The silo vulnerability issue is the biggest drawback to ICBMs and one of the better arguments used against silo basing by the proponents of mobile systems and SLBMs. Another argument is centered around the large number of warheads on the PEACEKEEPER force (10 RVs per missile). Theoretically this would allow the Soviets to expend two warheads to achieve a high probability of kill against a PEACEKEEPER silo containing one missile and 10 warheads. This provides a 5:1 exchange ratio in favor of the Soviets.

In an attempt to reduce silo vulnerability the Air Force has undertaken a silo upgrade program which hardens the silos somewhat.[12] These newer, harder silos are the ones used to house the PEACEKEEPER force and some of the MINUTEMAN III force. Other improvements to the force include better command and control procedures and equipment, and more accurate guidance systems.[13]

The U.S. ICBMs are currently based in silos at six locations.[14] All locations are within the north central region of the United States. One of the bases, F.E. Warren Air Force Base, in Wyoming, is the home for the PEACEKEEPER force as well as some MINUTEMAN missiles. The remaining locations contain only MINUTEMAN missiles. Post-START force projections contained with the CRS Study, shows that the ICBM force may be reduced to as few as about 600 silo-based missiles.[15] Although this figure assumes that the U.S. will not deploy a road-mobile ICBM system and will not develop the Rail Garrison PEACEKEEPER (RGPK) system, it does provide an "upper" limit projection of silo-based ICBMs. Assuming the force is reduced to only about 600 silo based ICBMs means that many existing facilities would no longer be needed. Unless the force was spread around the existing bases, there might even be the possibility of base closures with the associated personnel cuts.

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[12] Evidence on silo upgrade can be found in various Annual Reports to Congress from FY 1973 to the present (Melvin Laird, FY 1973; p. 68: James R. Schlesinger, FY 1976/77; pp. II-22 and II-26: Donald H. Rumsfeld FY 1977; p. 64: Frank C. Carlucci FY 1989; p. 233) The hardening of silos is also discussed in Jane's Weapons Systems 1988-89, p. 22. Jane's also discusses the hardening of command and control links as well as emergency power source upgrades.

[13] Jane's Weapons Systems 1988-89, pp. 22 and 26.

[14] FY 1989 Annual Report to Congress, p. 231.

[15] CRS Study, p. CRS-29.

On the other end of the spectrum of post-START ICBM force projections is a force comprised of a mix of road-mobile systems, silo-based ICBMs and RGPKs.[16] In this projection only 200 missiles would be silo-based. The remaining force would be distributed among 50 RGPK and 486 road-mobile weapons. In this scenario only one-fifth of the current ICBM silos would be needed. The road-mobile systems will need bases to operate from. One possible basing solution for the mobile ICBMs would be to place them on existing bases.[17] Although this may be the most economical solution, it may not be so from a military point of view. Namely, co-location of road-mobile and silo-based systems might place too many eggs in-one-basket to the advantage of the Soviet targeteer. Another solution would be to place the mobile systems on existing government-owned land (other than active ICBM bases). This option could utilize the "old" ICBM bases. But once again, it would appear that by placing the mobile systems on "old" ICBM bases, the Soviet targeting solution would be made easier because the Soviets would not have to re-map the area to be covered. In the opinion of this author, the most effective basing for the mobile systems would be to place them on existing government-owned land which currently has nothing to do with ICBMs or other items which the Soviets might already have targeted. Ideally this land would be somewhere in the north-central United States to preclude a very short time-of-flight SLBM attack. If based this way, the "old" ICBM bases could be closed with the resultant personnel cuts and negative impact on local economies.

Whichever post-START force structure the strategic thinkers and planners of the United States come up with, it appears that the ICBM force will feel a major impact in its current forces, as they are either cut back or have their major mission shifted to mobile systems.

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[16] CRS Study, p. CRS-35.

[17] Starr, p. 678.

3. SLBMs

SLBMs offer many of the advantages of ICBMs. They are quick to the target, reliable, and relatively accurate, although not as accurate as ICBMs. The difference in accuracy stems mostly from the inaccuracies contained within the SSBN navigation systems which "tell" the missiles their location at the time of launch. Without being 100 percent sure of the location of the launch point, it is difficult to get more accuracy than resides in the existing SLBM inventory. The TRIDENT II weapons system will achieve accuracies never before seen in an SLBM system.[18] Much of the increase in accuracy of the missile can possibly be attributed to the upgraded navigation system which is designed to greatly reduce the area of uncertainty of where the actual launch point is.[19]

Another major difference between SLBMs and ICBMs is their mode of communication. SLBMs, carried onboard SSBNs, are dependent on various radio broadcasts. These broadcasts are transmitted on several different frequencies and are thus redundant. The objective in the redundancy is to ensure that at least one of the transmissions reaches the SSBN. Although the system has proven quite reliable over the past 25 or so years, it cannot be as reliable as communicating over a "telephone" line. Thus, the command and control aspect with regard to SSBNs, is the major argument against placing more emphasis on SLBMs than on ICBMs.

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[18] The CEP of the TRIDENT II is given by Jane's Weapons Systems 1988-89 as 120 meters (p. 30).

[19] The TRIDENT II Strategic Weapons System utilizes state of the art Electrostatically Supported Gyroscopic Navigators (ESGN) rather than the Ships Inertial Navigation System (SINS) found in the TRIDENT I and POSEIDON weapons systems. The ESGN is designed to eliminate much of the "slop" found in the inertial components of the SINS. (Discussion of TRIDENT navigation systems can be found in D. Douglas Dalgleish and Larry Schweikart, TRIDENT, p. 29, Southern Illinois University Press, Carbondale, IL, 1984. The NAVSTAR program for increasing navigation accuracy is presented on pp. 253-255, and TRIDENT II accuracy on pp. 273-274.) A good source for a general description of the TRIDENT II navigation system is SSPO 0652-025-3 Volume 1, section 2-2.

The biggest advantage that SLBMs have over both bombers and ICBMs is in the area of survivability. SLBMs are not likely to be eliminated by a surprise attack, at least not to the extent that bombers and ICBMs could be. Of course, the small percentage of SSBNs that could be caught in port (about 25-30 percent) would likely be damaged or destroyed, but the large percentage at sea would survive. Only the possibility of a Soviet ASW "breakthrough" can pose a possible threat to the SSBN force. Because of their sea-basing and silent patrolling, the SSBN force has earned a reputation of being the most survivable leg of the U.S. Triad.

With the retirement of most of the POSEIDON submarines in the next decade, and the introduction of the TRIDENT II (D5) missile, the SLBM force will become a force comprised of more accurate, long-range missiles. In a post-START force all POSEIDON SSBNs would be retired, leaving only the TRIDENT SSBNs carrying the TRIDENT II missile.[20] The technological advances incorporated into the weapons system for the TRIDENT II result in creating the first SLBM system credited with a hard-target kill. This hard-target kill potential combined with the "stealth" of the SSBN make this leg of the Triad possibly the most effective and most important.

Another major advantage the SLBM has over either the ICBM or the bombers is that it is a system which can endure long periods of time (patrolling) without any external support. Bombers require refueling and silo-based ICBMs are not likely to survive repeated nuclear detonations. SLBMs, on the other hand, can remain on patrol indefinitely. SSBNs routinely patrol for approximately 70 days and can extend their patrols if necessary. Food is the limiting factor. If it is known early-on in a patrol cycle that the SSBN will be required to stay at sea longer than expected, the food can be rationed and the SSBN can stay on patrol much longer than 70 days. Should nuclear war break out during a patrol, it is anticipated that, during the patrol period, the NCA of the United States will regenerate, if necessary, and the communications links to the SSBN be re-established, thereby providing a nuclear reserve force capable of inflicting severe damage to any aggressor. This nuclear reserve force role can realistically only be assigned to SSBNs because of their endurability.

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[20] This assumes that the existing eight TRIDENT I equipped SSBNs will be back-fitted with the TRIDENT II weapons system.

SSBNs are currently based in four locations. Only two of these locations are equipped to handle the TRIDENT SSBN and only these two are expected to be utilized in an all TRIDENT SSBN force. Therefore, regardless of the post-START force mix, SSBN homeports will be reduced by 50 percent. This reduction will mean that at least the facilities which are dedicated to only SSBNs, will no longer be required. Personnel which perform only SSBN specific support at these locations will also not be required. Thus, the basing for SSBNs will shrink by 50 percent, and there will be associated cuts in personnel. This cutback will not be forced by any type of START agreement, but has been part of the Navy's plan for some time. The only thing that START may do is to regulate the maximum number of TRIDENT SSBNs the United States might use and to retire the POSEIDON and TRIDENT I-Backfit SSBNs earlier.[21] The original plan of the Navy called for 20 TRIDENT SSBNs. Post-START force projections predict the U.S. SSBN force to number between 15 and 18.[22] A "cut" of only two SSBNs in the Navy's plan should have little impact, especially when some of these SSBNs have yet to be constructed.

4. Modernization Plans

Much of the United States Triad is undergoing modernization. The bomber force is introducing the B-1B and looking forward to the B-2 "stealth" bomber. The ICBM force is finally getting a new missile in the PEACEKEEPER and is anticipating the construction of basing for the RGPK force. The SLBM leg of the Triad is currently finishing the flight testing of the new TRIDENT II missile. The combination of all of these improvements makes the entire force much more capable and credible. It also forces the Soviet's to consider the possible implications of launching a surprise attack on the United States. In this light, this modern strategic force is strengthening the nations deterrence.

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[21] Twelve POSEIDON-class SSBNs have been backfitted with TRIDENT I missiles.

[22] There are different rationales behind the different force structures which result in the number of SSBNs varying from around 15 to 18.

In addition to the improvements mentioned above, the Air Force is also researching the possibility of a road-mobile ICBM. Although funding for this program has been held to a minimum,there are many proponents of the concept.[23] The obvious advantage of a road-mobile system is that it makes it much harder for the Soviet planners to prepare for an attack that would have a relatively good chance of successfully eliminating a great percentage of the mobile systems without expending most of their missiles in a barrage-type fashion. The mobile system is projected to be one with a single warhead which would make it a costly target for the Soviet planner because of the poor warhead exchange ratio.[24] The drawback to the mobile system is that it would cost approximately $40 billion to complete, and would require about 8,500 Air Force and civilian workers to operate.[25]

Other areas of modernization and research include earth penetrating warheads (EPW) and the Advance Technology Bomber (ATB), otherwise known as the stealth bomber, or B-2.[26] The EPW is an attempt to hold at risk Soviet deep underground command and control shelters, and to counteract further Soviet underground hardening of ICBM silos. The B-2 is aimed at improving the penetration capability of the manned bomber and thereby improving the reliability of the bombers to deliver a weapon to the target.[27] As with any manned strategic bomber, the B-2 may also be able to track down and destroy the relocatable targets.[28]

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[23] FY 1989 Annual Report to Congress, p. 234.

[24] The Soviets could see a 5:1 exchange ratio in their favor for a silo based PEACEKEEPER. For a single warhead mobile system they would at best see a 1:1 ratio and would likely see a 1:2 exchange ratio in favor of the U.S. as they would be likely to assign two warheads to each mobile ICBM in order to achieve the desire high probability of kill.

[25] FY 1989 Annual Report to Congress, p. 232.

[26] "Burrowing Missile to be Built," NEW YORK TIMES, I, 18:1, September 13, 1988.

All modernization programs are designed to reduce or eliminate any disadvantages that a particular weapons system may have. Therefore, the silo vulnerability issue is "fixed" by a mobile system; the bomber vulnerability issue is "fixed" by a bomber that is "harder" and quicker, and ultimately with a bomber than is almost "invisible" to radar; and the SLBM inaccuracy issue is being "fixed" with the hard-target kill capable TRIDENT II missile.

B. ECONOMIC IMPACTS OF START

Many of the likely major impacts of a START agreement on the U.S. strategic forces have been suggested already. Many are centered on personnel. It appears obvious that if the United States is to reduce its strategic nuclear forces by 50 percent, some type of personnel cut will come about. In an era of "fiscally constrained" defense budgets it does not appear likely that these people could be channeled into other DoD jobs. Thus, a START agreement could contribute to unemployment, although probably not to a great extent.

Along with personnel cuts, there would be facilities closures. The old facilities could be redesigned to support other missions, but once again it appears unlikely. Some new facilities would be necessary if the United States decides to go ahead with plans for RGPK and the Small ICBM (SICBM). The acquisition of new facilities will be costly and, in an effort to offset these costs, the DoD is likely to sell off, or at the very least abandon, as many of the old facilities as possible. Along with facilities being closed there would be equipment which would no longer be needed. This equipment could be utilized to some extent in the new force, but much of the equipment is probably old and out of date for the new forces.

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[27] Penetration capability is improved by reducing the radar cross-section of the aircraft. See Bill Sweetman, "Challenge thrown down to Soviet air defences," Jane's Defense Weekly, Vol. 10, No. 22, p. 1377, December 3, 1988, for a full description on reducing radar cross-sections and the advantages of a low radar cross-section aircraft.

[28] Chain, p. 59.

The reduction in the personnel base, facilities and equipment could lead to some form of economic savings. Although it seems unlikely that this savings would offset the higher operating costs of the newer systems, it is possible that the DoD will realize some savings. Logic dictates that operating a force which has been reduced by about 50 percent should cost less. Only time will tell.

One item often overlooked by many people is the high technology world of the weapons industry. Relatively few companies have the personnel and capabilities to produce the strategic nuclear weapons which are being introduced and operated today. As nuclear forces are reduced in attempts to increase worldwide stability, the relatively small group of people who design and build today's weapons systems will likely get smaller. This means many of these talented people may be forced to seek work in other fields. By doing so, the nation's mobilization base, in the event of a crisis, for weapons production and development could be in jeopardy. Although it should not be necessary to fund research and development of new weapons systems just for the sake of maintaining this mobilization base, something should be done to retain this pool of highly skilled people should the need arise to utilize them. What should be done is a difficult question, and one which this author has no answer. The problem, however, is clear: without some method of retaining the small cadre of weapons research and development personnel, the United States mobilization base for high-tech weapons will be in jeopardy.

C. CONCLUSIONS

Even with the modernization of the U.S. strategic nuclear forces and the introduction of new weapons systems, a START agreement will mean force reductions to all three legs of the Triad. Although at initial glance it may appear that the Navy would suffer the biggest cut in its forces, from the current force of 36 SSBNs to a projected force of about 17, a closer look shows that the ICBM force is the leg of the Triad most likely to take big cuts. As mentioned above, the Navy has been planning for some time to achieve an SSBN force of only 20 TRIDENT SSBNs. Therefore a cut to about 17 is small by any standard. The current U.S. ICBM force is made up of 1,010 ICBMs. Force projections for a post-START force mix show as few as 612 ICBMs.[29] Thus, the ICBM force could feel a 40 percent cut in forces.

No matter which service feels the biggest cut, and how bad the force reduction feels to the nuclear forces, it may be necessary to reduce the forces if it is deemed to be in the best interest of the nation, and as long as the national security is maintained.[30] A START agreement may be in the best interest of the United Stated and the Soviet Union, and if so, the United States and Soviet Union must do everything in their powers to achieve such an agreement. The only guiding factors which both sides bring to the negotiations is that both sides must maintain the security of their respective nations.

The START agreement will reduce forces and may save money in the long run. Although this is not a large factor in pursuing a START agreement, it must be considered as one of the benefits of reaching an agreement. As mentioned earlier, the amount of savings is likely to be minimal, but in this age of cost cutting every little bit helps.

The reduction in forces should cause a reduction in personnel needed for operation and support of the forces. It is also likely to cause some base closures. The combined effect of these could have an impact on the economies of the areas surrounding the base closures and personnel reductions.

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[29] CRS Study, p. CRS-41.

[30] Obviously the final force mix will determine whether or not the agreement is the best interest of either nation.

Force reductions may have an impact on the weapons industry in that some of the talented research and development people may be forced to find work in different fields. This could result in the nation being unable to rapidly mobilize in the area of nuclear weapons should the need arise to do so.

Aside from the negative-sounding aspects, the force planners must form the best possible force structure with emphasis on survivability, endurability, accuracy and connectability. The force must also be cost effective, reliable, and be able to maintain the national security objectives which support the national interests.

The aspects provided above do not pertain only to the United States. The Soviet Union will have to look deep into its force structure and strategic doctrine in building a post-START strategic force. It will feel much of the same impact the United States will feel. Because of different strategic doctrine, however, the Soviet Union is likely to feel the impact in different places than the United States. The next chapter deals with this subject.

IV. THE SOVIET UNION AND START

This chapter examines the impact a START Treaty would have on the strategic nuclear forces of the Soviet Union. Areas discussed include naval forces, land-based forces (ie. ICBMs) and strategic bombers.

A. CURRENT SOVIET STRATEGIC NAVAL FORCES

The Soviet naval strategic nuclear forces are comprised of 3 major classes of SSBNs: TYPHOON, DELTA AND YANKEE.[1] Table 1 provides a summary of the Soviet SSBNs and their associated strategic weapons systems.

The oldest Soviet SSBNs are the YANKEEs which are equipped with the SS-N-6 missile. The YANKEEs are either being converted to SSGNs or SSNs, or decommissioned and/or dismantled.[2] This decommissioning/conversion is required in order to comply with the limitations set forth in SALT.[3]

The DELTAs come in four varieties. Missile systems include the SS-N-8, the SS-N-18, and the newest SLBM in the Soviet arsenal, the SS-N-23. The TYPHOON is the newest SSBN. It is the largest submarine in the world and carries 20 SS-N-20 missiles.

A review of Table 1 reveals that,compared with land-based systems, Soviet SSBNs have weapons systems with relatively poor estimated Circular Error Probables

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[1] START, like SALT, deals only with "modern" SSBNs. SALT defines Soviet modern SSBNs as the YANKEE, DELTA and TYPHOON classes. HOTEL SSBNs and GOLF SSBs will not enter into the START negotiation and will not be discussed in this article.

[2] Jane's Fighting Ships 1988-89, pp. 548, 553 and 559.

[3] SALT limits the Soviet Union to 62 modern SSBNs. Source is Jane's Fighting Ships 1988-89, pp. 548 and 559.

(CEPs) which translate into relatively low estimated Single Shot Kill Probabilities (SSKPs). Over time there has been a trend of increasing ranges, and multiple, lower yield warheads with decreasing CEPs.

The Soviet SSBNs are based in only two of the four operating Soviet Fleets: the Northern Fleet, homeported on the Kola Peninsula, and the Pacific Fleet homeported in Petropavlosk and Vladivostok. To date, all TYPHOONs and DELTA IVs are in the Northern Fleet. The remainder of the SSBNs are spit between the Northern and Pacific Fleets.[4]

Although the Soviets maintain a larger fleet of SSBNs than the United States, they maintain a smaller percentage at sea.[5] While the possibility of technical constraints may partially explain the low levels of alert SSBNs in the past, the practice appears to be related to much broader aspects of a Soviet operational philosophy.[6] These low alert rates are consistent with the Soviet Union's "...preference for conserving its military assets by limiting their peacetime operations and holding down the potentially high expense of maintaining a large military force."[7]

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[4] According to Jane's Fighting Ships 1988-89, p. 544, there are 38 SSBNs assigned to the North Fleet and 25 SSBNs assigned to the Pacific Fleet. This total of 63 SSBNs includes one Northern Fleet HOTEL III SSBN.

[5] "Only a small fraction of the strategic missile submarine force is deployed at sea." From Robert P. Berman and John C. Baker, Soviet Strategic Forces: Requirements and Responses, pp. 37-37, Brookings Institution, Washington, D.C., 1982. Three YANKEEs and three DELTAs on patrol in the Northern Fleet areas and two YANKEEs and two DELTAs on patrol in Pacific Fleet areas are numbers that James J. Tritten presented in his book entitled Soviet Naval Forces and Nuclear Warfare, p. 128, Westview Press, Boulder, CO, 1986. These numbers would indicate that of the 62 SSBNs allowed by SALT I, 10 would be at sea (in normal peacetime conditions). This equates to 16.1 percent at sea and 83.9 percent inport.

[6] Berman and Baker, p. 37. Originally from DoD Appropriations for 1980, Hearings, pt. 3, pp. 476-77.

[7] Berman and Baker, p. 37. Originally cited in Allocation of Resources, Hearings, pt. 4, pp. 67-68.

By keeping the majority of Soviet SSBNs in port the Soviets are able to reduce machinery wear, conserve fuel and maintain a ready fleet. It is possible that the Soviets may operate this way in order to allow inport SSBNs to actually cover "alert" target packages.[8] By operating in this manner the command and control problem would be simplified by having the SSBN tied to the pier and receiving communications from land-line as well as through normal fleet radio channels. Presumably in a state of heightened tension these SSBNs would be flushed out into areas close to the Soviet homeland.[9] The SSBNs would depart their homeports with the latest targeting updates along with the latest operational orders. The SSBNs would also deploy in as near a 100 percent condition of readiness as possible, having had direct access to maintenance facilities and keeping equipment either turned off, or used in such a limited way as to extend periodic maintenance requirements. By staying in home waters when they do deploy, the potentially complex problem of submarine command and control would still be simplified, and the risk of quick elimination by western anti-SSBN forces lowered. Although no open source could be found to corroborate this "theory", it does make a great deal of sense and seems to fall in line with the apparent Soviet strategic doctrine of keeping tight control over strategic forces.[10]

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[8] Admiral J. D. Watkins stated before the U.S. House of Representatives, Sub-Committee of the Committee on Appropriations, Hearings of Department of Defense Appropriations for 1986, that "The Soviets have ready submarines in port, 50 percent operating at sea and the rest are ready to fire missiles in port."(p. 927 of those hearings).

[9] Possibly to areas where coordinated Anti-Submarine Warfare (ASW) forces could assist in protecting the SSBNs from possible intruders.

B. CURRENT SOVIET STRATEGIC LAND-BASED NUCLEAR FORCES

As seen in Table 1, the Soviet strategic land-based nuclear forces are made up of several types of silo-based ICBMs as well as two new mobile systems, the SS-24 rail-mobile and SS-25 road-mobile ICBMs. According to the Congressional Budget Office, this arsenal contains no hard-target-kill capable warheads.[11] It is possible that the SS-24 may be a hard-target kill system if it is mated with a warhead larger than the 100kt warhead it is currently estimated to have.

START force proposals project that the Soviets will eliminate all ICBMs except their SS-18/24/25 systems. The latter include the newest systems with the highest SSKPs, and as will be discussed later, the extremely valuable mobile systems. As a corollary, the Soviets are projected to eliminate their "aging" systems in favor of more modern systems with much greater SSPKs.

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[10] A review of Soviet Command and Control found in Stephen M. Meyer, "Soviet Nuclear Operations," Chapter 15 of Managing Nuclear Options, edited by Ashton B. Carter, John Steinbruner and Charles A. Zracket,Brookings Institution, Washington, D.C., 1987, reveals the importance the Soviets place on the integrity of their command and control systems. Out of this one can imply that the Soviets would prefer to maintain close control over their forces rather than allow them to operate for long periods of time out of contact and working from an operation order.

[11] TRIDENT II: Capabilities, Costs and Alternatives, establishes three classes of Hard-Target warheads. A warhead that can achieve SSPK >70 percent against a 5000psi target is classified a Class 1 warhead. Those that have SSPK >70 percent against a 2000psi target are classified Class 2. Class 3 warheads must achieve at least 70 percent SSPK against a 500psi target.

C. CURRENT SOVIET STRATEGIC BOMBER FORCES

The Soviet Union has three classes of strategic bombers: BEARs, BISON and BLACKJACK.[12] Of these, the BISON bombers are extremely old and in need of replacement. The BEARs carry the majority of the weapons (estimated to be approximately 900) and constitute the greatest percentage of the bomber force.[13]

As will be seen below, CRS force projections for a post-START force predict that the Soviets will eliminate the aging BISON and BEAR A/B/C bombers in favor of the BEAR G and H and the BLACKJACK bombers.[14] This appears to be a logical approach and is one of the least controversial aspects of a post-START force postulation.

D. CURRENT SOVIET START FORCE PROJECTIONS

Table 4 presents a candidate Soviet post-START strategic force mix which would comply with the United States desire to eliminate mobile ICBMs.[15] Table 5, on the other hand, depicts an alternative force mix based on the Soviet preference to include the SS-24 and SS-25 mobile ICBM systems. Both Table 4 and 5 assume that the SS-N-20 carries nine warheads and the SS-N-23 only four. In a Joint U.S.-Soviet statement made after the Washington Summit on 10 December 1987, the ballistic missile counting rules were announced. Among these counting rules each SS-N-20 was to be counted as having ten warheads and each SS-N-23 as having only four.[16] Therefore, Tables 6 and 7 present the same force projections as Tables 4 and 5 with the only differences being the variations in reported SS-N-20 and SS-N-23 warhead counts. These "slight" changes have little effect on the overall force projection.

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[12] The BACKFIRE bomber has been excluded from the START negotiations as a result of the SALT I and SALT II (unsigned) treaties. During negotiations for SALT the BACKFIRE bomber was determined to be a medium-range bomber and thus not counted along with the heavy intercontinental bombers. Source is Jane's All the World's Aircraft 1987-88, p. 283, Jane's Publishing Co., London, England, 1987.

[13] CRS Study, p. CRS-70 credits the Soviets with 100 BEAR Bombers, 50 BEAR H Bombers, 15 BISONs. They have no figures for the BLACKJACK.

[14] The BISONs and A/B/C variants of the BEAR reached IOC in 1956. Source for this is Jane's All the World's Aircraft, pp. 280-281.

[15] Force projections are taken from the CRS Study.

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[16] Survival, p. 268, May/June 1988.

Table 4: Soviet Force Projection (without mobiles)

ICBMs:

	ICBMs	RVs/ICBM	Warheads
SS-18	154	10	1,540
SS-24 (silo)	104	10	1,040
SS-24 (rail-mobile)	N/A	N/A	N/A
SS-25 (silo)	720	1	720
SS-25 (road-mobile)	N/A	N/A	N/A
sub-total ICBMs/warheads	978		3,300

SLBMs:

	SLBMs	RVs/SLBM	Warheads
SS-N-20 (TYPHOON)	100	9	900
SS-N-23 (DELTA IV)	128	4	512
SS-N-8 (DELTA II)	16	1	16
SS-N-8 (DELTA I)	12	1	12
sub-total SLBMs/Warheads	256		1,440
Total ICBM/SLBM Warheads			4,740

HEAVY BOMBERS:

	Bombers	Whds/Bomber	Warheads
Bear G (Penetrate)	100	2	200
Bear H (Standoff)	100	10	1,000
Blackjack (Penetrate)	160	4	640
sub-total Heavy Bombers	360		1,840
START count (Bombers/whds)	360		1,260
True total SNDVs/Whds	1,594		6,580
START count (Total)	1,594		6,000

SSBNs:

	SSBNs	SLBMs/SSBN	Missiles
TYPHOON (SS-N-20)	5	20	100
DELTA IV (SS-N-23)	8	16	128
DELTA II (SS-N-8)	1	16	16
DELTA I (SS-N-8)	1	12	12
Total SSBNs	15		

Source: CRS Study, p. CRS-51.

Table 5: Soviet Force Projection (with mobiles)

ICBMs:

	ICBMs	RVs/ICBM	Warheads
SS-18	154	10	1,540
SS-24 (silo)	25	10	250
SS-24 (rail-mobile)	99	10	990
SS-25 (silo)	450	1	450
SS-25 (road-mobile)	450	1	450
sub-total ICBMs/warheads	1,178		3,680

SLBMs:

	SLBMs	RVs/SLBM	Warheads
SS-N-20 (TYPHOON)	100	9	900
SS-N-23 (DELTA IV)	80	4	320
sub-total SLBMs/Warheads	180		1,220
Total ICBM/SLBM Warheads			4,900

HEAVY BOMBERS:

	Bombers	Whds/Bomber	Warheads
Bear G (Penetrate)	40	2	80
Bear H (Standoff)	96	10	960
Blackjack (Penetrate)	100	4	400
sub-total Heavy Bombers	236		1,440
START count (Bombers/whds)	236		1,100
True total SNDVs/Whds	1,594		6,340
START count (Total)	1,594		6,000

SSBNs:

	SSBNs	SLBMs/SSBN	Missiles
TYPHOON (SS-N-20)	5	20	100
DELTA IV (SS-N-23)	5	16	80
Total SSBNs	10		

Source: CRS Study, p. CRS-57.

Table 6: Soviet Force Projection (without mobiles)

ICBMs:

	ICBMs	RVs/ICBM	Warheads
SS-18	154	10	1,540
SS-24 (silo)	102	10	1,020
SS-24 (rail-mobile)	N/A	N/A	N/A
SS-25 (silo)	756	1	756
SS-25 (road-mobile)	N/A	N/A	N/A
sub-total ICBMs/warheads	1,012		3,316

SLBMs:

	SLBMs	RVs/SLBM	Warheads
SS-N-20 (TYPHOON)	120	10	1,200
SS-N-23 (DELTA IV)	96	4	384
sub-total SLBMs/Warheads	216		1,584
Total ICBM/SLBM Warheads			4,900

HEAVY BOMBERS:

	Bombers	Whds/Bomber	Warheads
Bear G (Penetrate)	40	2	80
Bear H (Standoff)	96	10	960
Blackjack (Penetrate)	100	4	400
sub-total Heavy Bombers	236		1,440
START count (Bombers/whds)	236		1,100
True total SNDVs/Whds	1,464		6,340
START count (Total)	1,464		6,000

SSBNs:

	SSBNs	SLBMs/SSBN	Missiles
TYPHOON (SS-N-20)	6	20	120
DELTA IV (SS-N-23)	6	16	96
Total SSBNs	12		

Table 7: Soviet Force Projection (with mobiles)

ICBMs:

	ICBMs	RVs/ICBM	Warheads
SS-18	154	10	1,540
SS-24 (silo)	N/A	N/A	N/A
SS-24 (rail-mobile)	99	10	990
SS-25 (silo)	320	1	320
SS-25 (road-mobile)	466	1	466
sub-total ICBMs/warheads	1,039		3,316

SLBMs:

	SLBMs	RVs/SLBM	Warheads
SS-N-20 (TYPHOON)	120	10	1,200
SS-N-23 (DELTA IV)	96	4	384
sub-total SLBMs/Warheads	216		1,584
Total ICBM/SLBM Warheads			4,900

HEAVY BOMBERS:

	Bombers	Whds/Bomber	Warheads
Bear G (Penetrate)	40	2	80
Bear H (Standoff)	96	10	960
Blackjack (Penetrate)	100	4	400
sub-total Heavy Bombers	236		1,440
START count (Bombers/whds)	236		1,100
True total SNDVs/Whds	1,491		6,340
START count (Total)	1,491		6,000

SSBNs:

	SSBNs	SLBMs/SSBN	Missiles
TYPHOON (SS-N-20)	6	20	120
DELTA IV (SS-N-23)	6	16	96
Total SSBNs	12		

E. IMPACT OF START PROPOSALS ON SOVIET STRATEGIC NUCLEAR FORCES

As can clearly be seen in Tables 4 through 7, the SSBN leg of the Soviet strategic force mix will suffer the largest proportionate cuts if a START agreement is reached. It currently numbers in the range of 62 modern SSBNs. Force proposals as put forth by the Congressional Research Staff show a maximum post-START SSBN force numbering only 15, i.e., a reduction of 76.2 percent.[17] By anyone's standards this would be a drastic decrease. Total ICBM numbers could fall from the current inventory of 1,426 to approximately 1,039 (27.1 percent cut).[18] The Soviet long-range strategic bomber force could be cut from about 312 bombers to a projected force of 236 (a 24.3 percent cut).[19]

It is anticipated that, in the event, the Soviets are likely to retain their most modern and capable SSBNs and "retire" or convert their older boats. With five TYPHOON class SSBNs already built and two under construction it is likely that the TYPHOON will be the prime entity in the Soviet SSBN force.[20] The DELTA IVs are also very new. With four already built and one currently under construction it is unlikely the Soviets would scrap this program in favor of the DELTA's older versions.[21] As seen in Table 1, both the SS-N-20 and the SS-N-23 have estimated SSKPs of 4.1 percent. These SSKPs are more than 200 percent better than any other current Soviet SLBM system. Thus, these systems would most likely be the cornerstone of a Soviet post-START SSBN force.

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[17] This number would be accurate if the SS-N-23 is downloaded to carry only four warheads instead of the current estimate of 10.

[18] ICBM RV numbers could fall approximately 51 percent from 6,812 to about 3,316.

[19] Includes BEAR A/B/C/G/H, BISON and BLACKJACK Bombers.

[20] Jane's Fighting Ships 1988-89, p. 545.

[21] Jane's Fighting Ships 1988-89, p.546.

As mentioned earlier, the Soviets maintain the majority of their SSBN force in port (approx. 80 percent). Using current percentages of deployed versus inport SSBNs, a post-START force of 12 SSBNs would have only three SSBNs at sea while the remaining SSBNs would be tied up in port. Since a START-mandated cut in absolute numbers will raise the relative value of the remaining units, it would appear unlikely and unwise to retain such a high percentage of the force in port. It therefore seems logical for the Soviet Union to increase the fraction of SSBNs kept at sea to the percentages practiced by the United States.[22]

Placing a higher percentage of SSBNs at sea is probably not a simple thing to do, however. In order to do so, the Soviets will presumably have to increase the reliability of their systems to a point where the SSBNs will be almost as effective on the last day of their patrols as on the first day. The U.S. has made an extensive and costly effort to achieve this objective, over a period of 28 years. Hence, it is not obvious that the Soviets will be able to field a "reliable" SSBN force, capable of extended and repeated SSBN patrols, overnight. The alternative is to either get rid of the existing force altogether (or at least deemphasize it considerably) and replace it with systems that are equally survivable and more reliable, or to not change the SSBN operating patterns while relying on enough warning time to sortie the SSBNs out of port in a crisis.[23]

Their low-tempo deployment patterns suggest that Soviet SSBNs have not duplicated the U.S. two-crew system, and instead rely on a single crew. If, however, the Soviets are forced to increase the percentage of their SSBNs at sea, they will have good reason to investigate a two-crew concept of SSBN operations. Without a two-crew system it would seem very unlikely that the Soviets will be able to maintain a credible SSBN force with the amount of at-sea time that would be necessary in a post-START environment.[24]

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[22] According to Admiral Watkins, in testimony before the House Sub-Committee on DoD Appropriations for 1986, the U.S. keeps almost 70 percent of its SSBNs at-sea at any one time (p.926 of the Hearings).

[23] Some say the SS-24 and SS-25 land-based mobile systems could do this for the Soviets. Part of this argument can be found in the CRS Study, p. CRS-10.

Other areas the Soviets might have to improve on in order to maintain a higher percentage of SSBNs at sea include: the command and control system, personnel training, time intensive refit management, the reliability of the SSBNs mechanical systems, alert SSBN operations, and shore support. All of these areas require efficiency and mastery to permit extended SSBN patrols which may need to be the norm in a "weapons-scarce" post-START environment.

The "bottom line" to these questions is that the Soviets have a great deal of work ahead of them if they are determined to put a larger percentage of their SSBNs at sea in order to increase the survivability of a much smaller fleet. Whether or not it is too much work, and whether the Soviets are willing (and capable) to tackle the job is open for debate. Given the resources that have been invested in their modern SSBNs (ie. TYPHOON and DELTA IV) it seems unlikely that the Soviets would "scrap" them without at least giving it a try.

An SSBN force reduction to 12 or so will free up many conventional assets that are presently thought assigned to "pro-SSBN" defensive duties. This new "surplus" of general purpose forces will be available for alternative roles and missions. Could it be that the Soviets have seen this aspect of START and have been adjusting their military acquisition programs accordingly?

A reduction of the SSBN force to approximately 12 SSBNs would also free up a large amount of funding. Old SSBNs absorb much of the maintenance and refurbishment budget, and crews require constant training. By removing up to 50 "old" SSBNs the Soviets would ease the requirements for training, maintenance and overall readiness. This would result in a substantial savings, which the Soviet Union is in dire need of (as exemplified in any one of a number of public statements made by Soviet General Secretary Gorbachev). Many maintenance, training and homeporting facilities can be either reduced in scope or eliminated totally for substantial cost savings. Personnel requirements would likewise be cut as would be the associated shore support personnel needs.

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[24] Admiral Watkins stated in his testimony for the 1986 DoD Appropriations that the Soviets do have a two-crew system for their SSBNs (p. 927). However, this is the only open source found which makes this statement.

F. IMPORTANCE OF THE SS-24 AND SS-25 LAND-BASED SYSTEMS

If one were to construct the "ultimate" strategic weapon it might have the following characteristics:

1. Accuracy
2. Reliability
3. Long-range
4. Be difficult to counter-target (ie. survivable)
5. Be able to endure long after an attack
6. Inexpensive
7. Easily maintained

The Soviet Union's SS-24 and SS-25 land-based mobile missiles meet several of these criteria. They offer a degree of survivability heretofore only achieved by SSBNs, and at the same time, they can overcome the difficult command and control problem associated with SSBNs. The systems offer a much higher SSPK than any of the existing Soviet SLBM systems. Thus, if it is true that the Soviets are having difficulties with the reliability of their SSBNs, then it is reasonable to postulate that the Soviets may be willing to bargain away their SSBNs in favor of holding on to an inventory of SS-24s and SS-25s and their successors.[25]

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[25] CRS Study, p. CRS-10.

The U.S. position in the current START negotiations is for elimination of all land-based mobile systems.[26] With the introduction of the SS-24 and SS-25 and their relatively good SSKP values, coupled with the advantages mentioned above, it appears unlikely that the Soviets are willing to enter into any kind of agreement, prohibiting such "effective" systems. Ironically, it is conceivable that the Soviets got the original idea for the development of the SS-24 Rail-mobile system from earlier U.S. concepts along this line.[27] If so, the United States may take "credit", in part, for the "difficult-to-eliminate" mobile systems that the Soviets are deploying today.

G. THE "BEST" POST-START FORCE FOR THE SOVIET UNION

This section attempts to formulate the "best" post-START strategic force for the Soviet Union.[28] This force will be formed based on system characteristics and capabilities. The "best" Soviet strategic force mix in a post-START environment is presented in Table 8.

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[26] Although the formal U.S. position on land-based mobile systems is that they want them banned, there has been some indications of a softening of this position. This was cited previously in Chapter I.

[27] In the early 1960s there were plans for a rail-mobile Minuteman scheme.

[28] "Best" in this case refers to a force that has high SSKPs, is survivable, endurable, reliable, modern, flexible and economical.

Table 8: "Best" Soviet post-START Force

ICBMs:

	ICBMs	RVs/ICBM	Warheads
SS-18	154	10	1,540
SS-24 (silo)	40	10	400
SS-24 (rail-mobile)	60	10	600
SS-25 (silo)	100	1	100
SS-25 (road-mobile)	716	1	716
sub-total ICBMs/warheads	1,070		3,356

SLBMs:

	SLBMs	RVs/SLBM	Warheads
SS-N-20 (TYPHOON)	120	10	1,200
SS-N-23 (DELTA IV)	96	4	384
sub-total SLBMs/Warheads	216		1,584
Total ICBM/SLBM Warheads			4,940

HEAVY BOMBERS:

	Bombers	Whds/Bomber	Warheads
Bear H (Standoff)	96	10	960
Blackjack (Penetrate)	100	4	400
sub-total Heavy Bombers	196		1,360
START count (Bombers/whds)	196		1,060
True total SNDVs/Whds	1,482		6,300
START count (Total)	1,482		6,000

SSBNs:

	SSBNs	SLBMs/SSBN	Missiles
TYPHOON (SS-N-20)	6	20	120
DELTA IV (SS-N-23)	6	16	96
Total SSBNs	12		

1. Rationale Behind the "Best" Force

Starting with the SSBN issue, the Soviet Union clearly has invested a great deal of time and money in its TYPHOON and DELTA IV programs. These SSBNs carry the most effective SLBMs in the Soviet arsenal. SSBNs offer the Soviets an effective strategic reserve force which can be used in a war termination role. Thus, it would appear unlikely that the Soviets would give up their SSBNs entirely, but rather make the effort to use them in much the same way as the United States does, i.e., keep them at sea. Since there are already five TYPHOONs and four DELTA IVs it seems reasonable to postulate a force of at least ten SSBNs, and more likely a force of 12. This force is based on the assumption that the SS-N-23 will be downloaded to carry only four warheads and not ten as it is currently credited with.[29] A force of 12 SSBNs would require much less total pro-SSBN support from conventional forces and still provide a strong war termination bargaining "reserve" (ie. up to 1,344 warheads).[30]

In the area of ICBMs, the "best" solution for the Soviets would be to allow land-based mobile systems. The Soviet insistence in retaining mobiles may imply the intention to adopt a no-first-use policy.[31] From a pure deterrence standpoint, this is very desirable to both sides.

Although manned bombers have great flexibility in targeting and are recallable, they are easily targeted when on the ground, are relatively soft-targets, cannot deliver its weapons as fast as an ICBM or SLBM, and have much less of a chance than ballistic missiles to reliably deliver their weapons against a designated target. Bombers are also costly. For these reasons it would best suit the Soviets to limit their bomber fleet to that specified in Table 8.

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[29] Table 1 shows that the SS-N-23 is currently credited with ten warheads. As previously mentioned, the Soviets have stated that for the purposes of START counting the SS-N-23 will have only four warheads. This means the SS-N-23s will either be grossly underloaded if they continue to carry the present warhead, or, they will deploy with a new, heavier, warhead which would increase the SSKP of this system.

[30] Although the SSBN force may be cut by about 80 percent it is unlikely that the pro-SSBN forces would take a proportionate cut. A smaller SSBN force would make each unit much more valuable, thereby precluding a straight 80 percent cut in pro-SSBN forces. Overall, the pro-SSBN forces will feel a large cut. However, the pro-SSBN support for each SSBN will most likely increase.

[31] For further discussion see CRS Study, p. CRS-17.

The aggregate of such a force provides the Soviets with a capable, effective, modern nuclear strategic force. It combines the best of the three legs of a Soviet "Triad". It also allows for economy of assets in that the force reduction will cost little more than has already been spent, and it will eradicate the costs of maintaining the eliminated aging assets. This mix will raise the overall force SSKP, thereby making it a more deadly force.[32] It will allow the Soviets to somewhat deemphasize the importance of their SSBNs because of the great deterrent value of their mobile systems. Overall, this force will enhance the Soviets strategic nuclear credibility, while at the same time reduce costs and eliminate thousands of nuclear weapons, resulting in world approval. The Soviets can successfully get the best of both worlds; worldwide approval (i.e., political gains) and a credible and deadly nuclear force (i.e., military gains). While doing so they can greatly reduce costs, thereby also achieving economic benefits.

H. CONCLUSIONS

It is clear that the START force proposals put forth in this chapter, which provide the Soviets with a very credible force, will have a great impact on Soviet strategic nuclear forces, as well as the entire Soviet military. The major impact will be felt in the SSBN fleet with a reduction from 62 to approximately 12 SSBNs. This reduction will bring with it a cutback in shore support facilities and personnel. The reduction

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[32] Average force SSKP against a 5,000 psi target (calculated by averaging SSKP per warhead for each missile type and averaging these figures over the entire force) prior to a START (excluding bombers) is 25.268. For the post-START force listed in Table 8 (less bombers) this value is 33.404. Comparable U.S. figures are 24.766 prior to START, and 81.907 after START (using a "mean" of the projected START force proposals presented in the CRS Study).

SSBN duties. The result will be a smaller, more credible SSBN force which will keep a higher percentage of the force at-sea.[33] This force will likely be manned by a two-crew system similar to that the U.S. utilizes. Maintenance and training crews will have to work harder to keep the ships on their deployment schedule. Money will be saved from the reduction of ships and shore facilities, but will be spent on improving the reliability of critical system components. Overall, there will be a net savings in money, people and facilities.

ICBMs will be reduced in numbers of warheads but the overall SSKP for the ICBMs will increase dramatically. The ICBM force will be modern, mobile, deadly and much more survivable than the current force.

Based upon the above information it would appear that the Soviets can only stand to gain (politically, militarily and economically) from a START Treaty. It is the opinion of this author that it is because of these potential gains that the Soviets keep returning to the negotiating table rather than just walk away.

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[33] More credible because it will be modern, quiet, have a relatively good SSKP, be harder to locate by western ASW forces even in a non-generated posture.

V. U.S. POST-START FORCE STRUCTURE

The previous chapters have discussed the background issues associated with a START pact. This chapter presents a post-START strategic force structure which this author believes would be "best" for the United States. This chapter also briefly touches on the potential impact that issues such as SDI, mobile ICBMs and SLCMs could have on a "final" force mix and the START process in general.

A. FORCE CRITERIA

As stated in the Chapter I, any post-START strategic nuclear force mix must be structured so as to ensure the national security objectives of the United States, and thus secure the national interests. The criteria for the "best" force mix is defined according to the preference of the author. There are many post-START force mix proposals presented in a wide variety of open literature. Some of the ideas and force structures have been presented earlier. Each force mix has certain criteria that its proponent feels contributes to the best mix of forces. This author will combine the better parts of many force mix proposals along with personal judgments, and will formulate the "best" post-START force mix for the United States.

Before a force mix can be built, the criteria of the force must be defined and prioritized. Each aspect of the force is examined below and evaluated for the relative priority it will have on the final "best" force mix.

1. Survivability

A key aspect of any force is its ability to survive an attack by any aggressor. A force which is not survivable is a force which so limits the flexibility of the NCA that it is of little value in maintaining the national security. A force that is not survivable might only be used in a LOW/LUA mode and thus not be conducive to crisis stability.

The definition of survivability for this author is the ability to "ride-out" a massive first-strike from an aggressor. Being able to ride-out a massive first-strike implies that the force is then capable of retaliating and inflicting damage on the aggressor. Currently, the U.S. ICBM and bomber force are not considered survivable, at least not according to this definition.[1] Any portion of the SLBM leg of the Triad that would be caught inport would also not be considered survivable. The only current forces which meet the criteria of being survivable are the deployed SSBNs.

It is the opinion of this author that survivability should be a high priority in the design of any strategic nuclear force. It will, therefore, be one of the highest priorities of the "best" force presented below.

2. Connectability

Connectability is the ability of the force to maintain communications with the NCA, especially during a crisis. Ideally, the command and control links would be hardened and virtually invulnerable to any type of attack. Maintaining the communications links with the proper nuclear release authority is essential in order to accomplish the mission. Without that communications link, the forces are almost useless. In today's forces only the ICBMs come close to being connectable 100 percent of the time. As part of the silo upgrade programs mentioned in Chapter III, the communications links have been hardened and redundancy has been built-in to increase reliability.[2] Although the communications systems on the bomber and SSBN legs of the Triad have been made very reliable, they can not approach the reliability which is inherent in a dedicated communication line (i.e., a "telephone" link).[3]

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[1] Modernizing U.S. Strategic Offensive Forces: The Administration's Program and Alternatives, pp. 21-23 and 99-110.

[2] Jane's Weapons Systems 1988-89, pp. 22 and 26.

[3] There are many very technical aspects to connectability which will not be mentioned in this thesis because they are not considered essential to the overall concept of connectability. To include these technical aspects would only detract from the "strategy" of the force mix, which is the desired goal. For a description of SSBN

Connectability must also be listed among the highest priority items in designing a force mix. Without the ability to communicate with the NCA (even if "communicate" means only to listen) the net worth of the force would be questionable.

3. Endurability

Endurability is the ability of the force to endure independently for long periods of time, especially after an attack. A force which can endure is a force which can be used for war termination efforts and, when coupled with survivability, forms a force which projects a strong deterrent value. SSBNs at sea are obviously very enduring forces; as discussed in Chapter III, patrol duration is limited only by onboard food supplies. ICBMs have become more enduring with the upgrading of silos, including better emergency power supplies. However, they still fall short of the endurability of the SSBN. Arguably, the bomber force possesses the least amount of endurability in that it relies on refueling in order to remain in the air. Without refueling, strategic bombers are only capable of contributing to the Triad for as long as their initial fuel loads hold out.

Though not as high on the author's priority list as survivability and connectability, the ability to endure is an important aspect for a force to have. Endurability is essential for war termination and crisis stability. It also contributes to the overall deterrent effect that the force projects.

4. Accuracy

The measure of accuracy is fairly simple. A review of CEP data, similar to data presented in Tables 1 and 2, is usually all one needs to measure the accuracy of a component of the force. Accuracy has a direct bearing on SSKP which correlates, in turn, with hard-target kill capability. Ideally, accuracies are good enough to allow the warhead yield to become so low as to preclude collateral damage, while at the same time reliably destroying the target. In the current force, ICBMs have the highest

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command and control links see W. J. Holland, RADM, USN, "The Link to the Boomers: The Triad's Best!," U.S. Naval Institute PROCEEDINGS, pp. 41-50, January 1988.

accuracy. Bombers, in a penetrating role, should have the next best accuracy.[4] The element of the current forces which has the lowest (relative) accuracy is the SLBM. The TRIDENT II missile should overcome this weakness and place the SLBM alongside the ICBM in system accuracy.

Accuracy affects the target set a weapons system can cover. An accurate system can cover all target sets, while an inaccurate system may only be suitable for soft-targets or countervalue targeting. Therefore, in order to build a force with maximum flexibility, the force must have highly accurate weapons. One method of overcoming poor accuracy is to increase the weapon yield. While this method will raise the SSKP for the weapon, it will also raise the weight of the warhead and increase the chances for undesirable collateral damage.

5. Reliability

A weapons system that is unreliable is worthless. Reliable systems are costly and can take long periods of time to develop. The reliability which is used in this thesis refers to the probability a weapons system has of delivering a weapon to a target and detonating that weapon at the prescribed location. Actual reliability figures for U.S. strategic nuclear weapons systems are found only in classified documents. This data is collected and compiled through numerous flight tests of various systems.

Reliability ranks very high among the items necessary to have a credible force because, as mentioned above, an unreliable force has little or no value.

6. Cost-Effectiveness

Ideally a weapons system will maximize the utilization of funding spent on development and procurement by providing a very good product. A "very good product" might be a system which has high ratings in all of the above categories. Modern strategic systems are very costly. The current era of fiscal constraint necessitates that all new weapons systems be cost-effective. Perhaps this is why there is such a great debate over silo based ICBMs and manned bombers. Perhaps the impression is that they are too vulnerable to attack and therefore not cost-effective.

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[4] No accuracy figures could be found for bombers performing in a penetrating role. It is assumed that with state-of-the-art electronics, the bomber can place a bomb on the target with relatively good accuracy.

Although cost should not dictate which system is best for any nation, when combined with effectiveness, cost-effective systems are the only ones which are likely to have a future. Logic does not support the procurement of systems which are not cost-effective. When a system is deemed to be not cost-effective, it is usually because there are alternatives which perform the same prescribed mission, with equal reliability, at a lower cost. Unless the system can be made competitive by increasing its cost-effectiveness, its future is likely to be doubtful, as alternative systems will probably replace it.

B. THE "BEST" POST-START FORCE MIX FOR THE U.S.

Based on the criteria put forth above, a force mix is presented in Table 9. The systems which are included in Table 9 are those which are either operational, in the final stages of testing prior to becoming operational, or currently under development and funded. Table 9 has excluded the B-2 bomber because of the lack of data available on a potential payload and the possible funding problems it faces.

If a post-START force mix can be created which will meet all of the criteria discussed above, then the United States could feel secure in pursuing a START deal which might reduce their strategic nuclear forces by about 50 percent. If, on the other hand, only part of the criteria can be met, the United States would have to consider the advantages and disadvantages of a START deal prior to finalizing it.

TABLE 9: U.S. POST-START FORCE MIX

ICBMs:

	ICBMs	RVs/ICBM	Warheads
MINUTEMAN III	45	3	135
PEACEKEEPER (silo)	50	10	500
PEACEKEEPER (Rail-Garrison)	50	10	500
SICBM (mobile)	500	1	500
sub-total ICBMs/warheads	645		1,635

SLBMs:

	SLBMs	RVs/SLBM	Warheads
TRIDENT II (D5)	408	8	3,264
sub-total SLBMs/Warheads	408		3,264
Total ICBM/SLBM Warheads	1,053		4,899

HEAVY BOMBERS:

	Bombers	Whds/Bomber	Warheads
B-52 (Penetrate)	104	20	2,080
B-52 (Standoff)	45	20	900
B-1B (Penetrate)	97	24	2,328
sub-total Heavy Bombers	246		5,308
START count (Bombers/whds)	246		1,101
True total SNDVs/Whds	1,299		10,207
START count (Total)	1,299		6,000

SSBNs:

	SSBNs	SLBMs/SSBN	Missiles
TRIDENT (TRIDENT II)	17	24	408

C. RATIONALE BEHIND THE "BEST" FORCE MIX

The objective behind the force mix listed in Table 9 is to achieve the "best" mix of strategic forces for the United States, given the anticipated START constraints. The combination of forces is designed to maximize the benefits of each system, while at the same time minimizing individual weaknesses. The force is designed to be able to achieve the national security objectives mentioned in Chapter I, for a force which can not achieve these objectives is one which the United States can not allow. Each leg of the Triad is examined in its post-START structure (as presented in Table 9). The impact of the reductions in numbers of each leg is discussed in terms of the considerations put forth in Chapter III.

1. ICBMs

The ICBM force specified in Table 9 is one that, at least in the opinion of this author, will provide a force with a greater chance of survival through the deployment of mobile systems. The portion of the force which would be silo based could be placed in silos super-hardened up to about 25,000 psi. This super-hardening would force the Soviets to have to increase the accuracy of their weapons in order to achieve a reasonable expectation of destroying the weapon in the silo. Following the formula for SSKP in Chapter I, an SS-18 would have to have a CEP of about 100 feet in order to achieve a SSKP of 90.[5]

The RGPK force would be positioned on 25 trains with 2 missiles per train. The trains would be flushed out into the rail network upon strategic warning. If the trains are unable to be dispersed, and are taken by "surprise" in an attack without warning, the numbers which would be lost would not degrade the nation's strategic forces to any great extent. A maximum of 500 warheads could be lost, and the likelihood that the attack would achieve a 100 percent kill probability against the RGPK force is probably small.

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[5] An alternative to increasing accuracy is to increase the yield of the warhead. To achieve an SSKP of 90 with the current CEP, an SS-18 would need a yield of 17 MT.

The mobile force of SICBMs could be dispersed on existing U.S. bases at locations in the north-central part of the United States. Basing this way would reduce the probability of a successful short time of flight attack from SLBMs positioned along either U.S. coast, and the dispersal pattern would make the targeting problem for the Soviets very difficult. Ideally, the SICBMs would be moved at frequent and random intervals to further complicate the Soviet targeting problem. The SICBMs could be further dispersed in periods of heightened tension, thereby increasing their probability of survival during an attack.

The impact of the reductions on the ICBM leg of the Triad would be minimal. Although only 95 missiles would be based in silos, and the support forces for missile silos would require reductions, there would also be a need for support and operating personnel for the new mobile systems. As mentioned in Chapter III, the Secretary of Defense estimated that 8,500 people would be required to operate and maintain the SICBM force. The 25 trains for the RGPK force would probably require a sizable number of its own personnel for operation and maintenance. Thus, the personnel which would no longer be required for the eliminated ICBMs, could be re-trained to operate and maintain the SICBM and RGPK force.

In all, the ICBM force would be reduced from 1,010 missiles to 645 missiles (a 36 percent cut), and the associated warhead count would be reduced from 2,480 to 1,635 (a 34 percent cut). The overall ICBM force SSKP average, against a 5,000 psi target, will increase from 56.71 to 61.14 (assuming the SICBM to have the same CEP and yield as the PEACEKEEPER missile, and that MINUTEMAN III has no improvement in accuracy or increase in yield). This is an increase of about eight percent in SSKP. Therefore, the force would be more deadly (through increased accuracy), more survivable, more able to endure after an attack, more reliable, and still maintain its high level of connectivity. Altogether therefore, it would be more cost-effective than the current ICBM force. This type of ICBM force mix could provide U.S. planners with greater flexibility and allow the NCA a greater number of employment options. The combination of mobile systems and super-hardening of silos should greatly reduce the need (or appeal) of any type of LOW/LUA policy being utilized, thereby contributing to crisis stability.

2. SLBMs

The SLBM force would take probably the smallest cut in forces. The planned fleet of 20 TRIDENT SSBNs would be cut to 17 (a 15 percent cut). The TRIDENT II weapons system would still provide maximum survivability, endurability, accuracy, reliability and cost-effectiveness. With the recent improvements to the command and control links, the connectivity of the SSBNs is nearing the level of the ICBMs.[6]

Practically speaking, reduction of SSBNs to 17 is almost artificial. With only eight TRIDENT SSBNs operational at the time of this writing (early 1989), and one in final testing and acceptance, there will be many years before the numbers of SSBNs approaches 17.[7] The planned procurement rate of one TRIDENT SSBN per year would bring the TRIDENT force level to 17 in 1997.[8] As long as a START deal can be finalized before 1997, there should be little or no impact on the SSBN programs.

START will have little affect on the SLBM programs of the United States. The TRIDENT II modernization plans will continue as scheduled. The projected end-strength of SSBNs will be reduced somewhat, but without the physical existence of the "20" SSBNs, a "reduction" to 17 is only felt on the drawing board. The reduction in SSBN bases is already programmed with the phasing out of the POSEIDON SSBNs. Therefore, START will have the least impact on the SLBM leg of the Triad.

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[6] Some might argue that the command and control links for the SSBNs are better and more reliable than for either bombers or ICBMs. See the U.S. Naval Institute PROCEEDINGS article by RADM Holland.

[7] FY 1989 Annual Report to Congress, p. 235.

[8] FY 1989 Annual Report to Congress, p. 235.

3. Bombers

Although the author has attempted to remain objective in the determination of what is the "best" strategic force mix for the United States, it is difficult to place a great importance on the manned bombers because of their vulnerability to attack while on the ground, as well as to defensive systems while airborne. The bomber force mix presented in Table 9 is made up of the residual numbers available after the ICBM and SLBM legs of the Triad are maximized to the extent of the START proposals (i.e., 4,900 ballistic missile warheads). Not discounting the importance of the manned bombers in locating and destroying mobile targets, it is very difficult to compare these systems with the reliability of ballistic missile systems in delivering weapons to designated targets.

The proposed force is made up of both standoff and penetrating B-52s and B-1Bs. Since the B-1B has been designed as a penetrating bomber, it has been "assigned" a penetrating role only. The small number of penetrating B-52s is a result of the number of standoff B-52s. With only 97 B-1Bs (97 warheads by START count), the numbers of B-52s seemed to be maximized by assigning 45 B-52s to standoff roles (900 warheads) and using the remaining 104 in a penetrating role (104 warheads by START count). This results in a START count of 246 bombers and 1,101 warheads, with an actual count of warheads being 5,308.

The bomber force would be reduced from 291 bombers to 246 (a 15 percent reduction). This reduction would be made entirely by eliminating, or converting, the oldest bombers and utilizing only the most modern strategic systems available. Should the B-2 program continue and be successful, B-2s would be expected to replace the B-52s and complement the B-1Bs. The B-1Bs would then be likely to shift from penetrating to standoff roles, allowing the B-2 to perform the penetrating missions. A 15 percent reduction in forces should have little overall affect on the bomber force. There should be little reason to close bases and lay-off large numbers of personnel.

4. Force Strategy

The overall objective of the force projection in Table 9 is to maximize the criteria mentioned above which makes up a good force. In the opinion of this author, the force listed reduces the ICBM vulnerability issue through the introduction of mobile systems and super-hardening silos; it maximizes the utility of the accurate and survivable TRIDENT II missile by almost achieving the maximum allowable number (3,300) of SLBM warheads; it maximizes the overall numbers of allowable ballistic missiles (ceiling of 4,900 proposed); and it reduces the importance of manned bombers without great impact to the forces and without any apparent funding increases.

The force mix presented in Table 9 is capable of fulfilling almost all possible strategies of the United States. It will provide the planners with a more flexible force, in that the previously vulnerable land-based ballistic missiles will be made harder to kill through hardening or mobility. The planners will also have the first hard-target kill SLBM system, with all of the associated advantages that SLBM systems have. The bomber leg will be comprised of the best possible mix of penetrating and standoff bombers that can be achieved without relying on stealth technology. The result of this is that the forces can perform their assured destruction roles, damage limitation roles; they can ride-out an attack and endure long after the attack; they can provide maximum flexibility to the NCA in determining what type, if any, retaliatory strike is appropriate; and they can do this with only one leg of the Triad seeing any real program changes. It is based on all of these options available with this force, that this author believes this is the "best" force for the United States.

D. ADDITIONAL START ISSUES

The Soviets have insisted so far that there will be no START deal without negotiating SDI. The United States has refused to include SDI in any START talks. If a START deal is to become reality, it is clear that this impasse must be overcome. Possibly some arrangement to handle SDI along with new ABM talks could provide a solution. If not new ABM talks, possibly the issue could be removed from the START talks and dealt with in some other arms control negotiations.

Assuming that a START pact is consummated, and assuming the United States has developed the technology for some type of SDI missile defense system, the force structure could change radically. The SDI system could eliminate, or at least reduce, the possibility of ICBMs being killed in silos. It could also provide the United States population centers with at least some level of security. This would allow U.S. strategic forces to stand almost entirely in a war reserve role, awaiting war termination. It would make it difficult, if not impossible, for the Soviets to come up with any scenario whereby their first-strike would have any potential for disarming the United States. With the removal of the silo vulnerability issue, there would be no need for the expensive, single-warhead SICBM or the multiple warhead RGPK system. A return to MIRVing silo-based ICBMs would be "safe." Bomber survivability would be increased dramatically and therefore much of the argument over why the U.S. should not have bombers could fade away. Many things would, or could, happen with a successful SDI system deployed. As the SDI program appears now though, it will be some time before any type of system can be deployed, and the initial systems are likely to provide only a marginal degree of safety.

The issue of mobiles appears to be easier to solve than SDI. The Soviets already have two mobile systems, the SS-24, rail-based system, and the SS-25, road-mobile system. The United States is pursuing the RGPK and SICBM mobile systems. It would appear to this author, that these mobile systems provide for an increase in overall strategic stability by presenting strategic systems which are almost invulnerable to attack. This high survivability should lend itself to deterring any type of first-strike, as it would be very unlikely that any first-strike would disarm either side to any great extent. Therefore, it would appear that the United States, as mentioned in Chapter I, may be backing down on its position of banning mobiles and thus, this issue will be put to rest.

As an alternative to simply backing down from its insistence on banning mobile systems, the United States could utilize them as a bargaining chip in the SLCM issue. If the Soviet Union were to decouple the SLCM issue from the START negotiations, then the United States might withdraw its position against mobile systems. This quid pro quo would allow the United States to develop and procure systems already in the "pipeline," and, at the same time, remove the SLCM issue as an obstacle to further progress towards a final START agreement.

As was briefly mentioned in Chapter III, the concept of extended deterrence may be affected by a START deal. With forces reduced by about 50 percent, it would seem likely that at least the degree to which United States strategic forces can be counted on to provide extended deterrence on behalf of its allies would be reduced. The amount of reduction could only be speculative in this thesis. At least one author feels that START will have no effect on extended deterrence. Robert S. McNamara states:

> "Because the reductions in START are so balanced and will enhance the overall survivability of U.S. strategic forces, and because the United States would still retain nuclear weapons numerous enough and flexible enough to support NATO strategy, the U.S. capability to use nuclear forces in defense of Europe would remain unchanged. Therefore, whatever role strategic nuclear forces now play in deterring the threat of Soviet conventional aggression -- one that I regard as minimal -- they would play an equal or greater role after they are adjusted to the treaty limits."[9]

There would be no simple answer to how much, if any, impact the START negotiations might have on extended deterrence. Like other issues such as targeting and weapons assignment, extended deterrence would have to be prioritized among the other national goals and objectives.

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[9] Robert S. McNamara, "The New Administration and the Future of Arms Control," Arms Control Today, Vol. 18, No. 10, p. 5, December 1988.

E. BEYOND START

Assuming that some type of START deal is finalized in the next few years, could both sides continue to reduce weapons to even lower limits? If reduced beyond the expected 6,000 warhead limit, would either the Soviet Union or the United States feel secure? At least one open source states that the next step for further reductions would be the 3,000 warhead level.[10] Reflecting on the complexities encountered in a reduction to the 6,000 warhead level, this author would expect to see many changes to force policy, structure, employment and targeting strategy if a reduction to 3,000 warheads is ever planned. The question that must be answered is whether or not a force of 3,000 warheads would suffice to maintain the national security objectives and thus be in the nation's best interest.

F. FINDINGS AND CONCLUSIONS

Based on the evidence presented above, and a review of the references in preparing this thesis, is appears likely that some type of a START treaty will be negotiated in the relatively near future (i.e., the next few years). The impact of strategic nuclear force reductions would be minimal to the extent that the reductions are not likely to alter each leg of the current Triad to a great extent. The ICBM leg is likely to feel the biggest change if the United States is willing to make the investment in mobile systems. SLBMs will feel no real change in their programs, and bombers may only be forced to retire (or convert to conventional duty) about 50 aircraft. Current targeting policy should not require any significant revision, but the target data base and target plans will probably have to be re-prioritized as the number of targets grows proportionally to the reduced force. Both the Soviet Union and the United States have the opportunity in START to modernize their forces and end up with force mixes which can have an overall better hard-target kill capability and be more survivable to any attacking force. In sum, the findings of this thesis indicate that a START deal will have little chance of creating an adverse effect on either United States or Soviet strategic nuclear forces, and therefore, with the exception of a few relatively minor issues, a START deal appears imminent.

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[10] May, Bing and Steinbruner, Strategic Arms Reductions, pp.6 and 7.

The conclusions that this author has come to, and supported with the body of the thesis, are as follows:

a. The United States should continue to pursue mobile ICBM systems in general, and in particular the SICBM. The RGPK proposal will give the ICBM more survivability than a silo-based missile but it will present a very tempting target to Soviet planners, as it has 10 warheads per missile and with two missiles per train could potentially lose 20 warheads with one direct hit from a single Soviet warhead.

b. The United States should de-emphasize the manned bomber for strategic nuclear weapons delivery because of its vulnerability to incoming weapons (while on the ground) as well as to air defense systems (while airborne). As such, the United States should stop development of the B-2 "stealth" bomber and re-channel strategic funding into mobile ICBM systems.

c. START will have little or no effect on the SLBM leg of the Triad. A force of 17 TRIDENT SSBNs equipped with TRIDENT II (D5) missiles will present a formidable force and will provide planners with greater flexibility in target assignment and weapons employment policies.

d. START limitations, as specified in Chapter I, do not present the United States with limits which will adversely effect its strategic forces. The force mix presented in Table 9 clearly demonstrates that, although the force will be reduced, it will be more survivable, more accurate, more able to endure and more cost-effective than the current force structure.

e. As exemplified in the force mix proposed in Table 9, the START limits will not cause the United States to fail to meet its most pressing national security objectives. In fact, the national security objectives should be met with reduced forces without many changes to existing strategies. The weapons ceilings which may come with the signing of a START deal will still allow the United States to design a robust strategic nuclear force which will be quite capable of securing the national interest. As such, it is this author's conclusion, that the START negotiations should continue and all obstacles overcome in order to achieve a completed START agreement. A completed START agreement, if near to the proposed form presented in Chapter I, is in the best interest of the United States and also appears to be in the best interest of the Soviet Union. It is in the best interest of both nations because the resultant forces would be smaller, thereby reducing the possibility of accidental launching, more cost-effective in that they will be more survivable, and more accurate, thus making them more flexible to planners. The reduction in forces may also present some monetary savings by eliminating the maintenance of aging systems. These savings are likely to be offset, however, by the rising costs of newer, more complex and more reliable systems.

The force mix presented in Table 9 is but one example of the type of force mix which could be constructed while staying within the limits of the current START proposal limitations. Many other force mixes could be constructed with emphasis on different systems. The flexibility which these limitations still allow is the primary reason why the START negotiations should continue. When either side can maintain their nation's security, and thus their national interests, while at the same time reducing their strategic nuclear arsenals, it is the best interest of these nations to do so. Pursuing an agreeable START deal should culminate in achieving these reduced forces without reducing either nation's security.

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